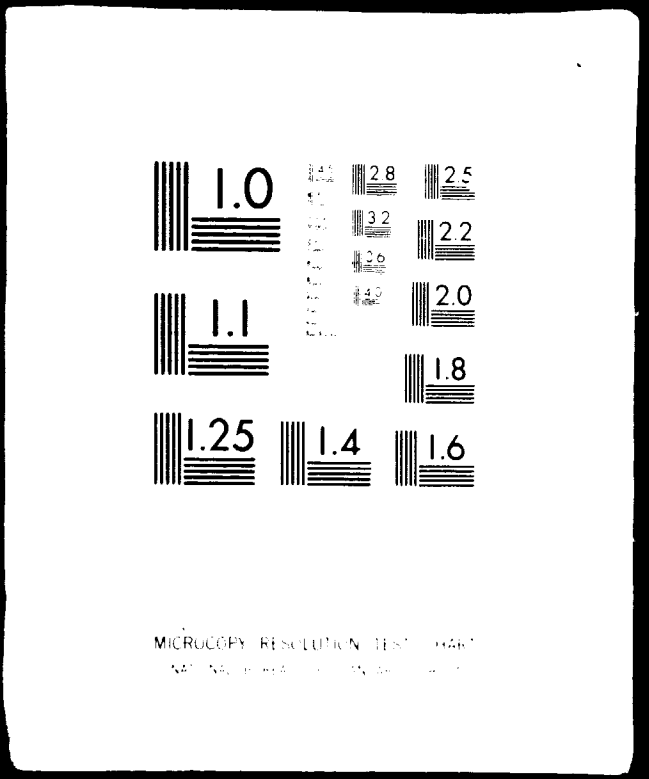
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NASA TECHNICAL MEMORANDUM

NASA TM X-

(NASA-IM-X-73910) PRELIMINARY TEST RESULTS OF THE JOINT FAA-USAF-NASA RUNWAY RESEARCH PROGRAM. PART 2: TRACTION MEASUREMENTS OF SEVERAL RUNWAYS UNDER WET, SNOW COVERED, AND DRY CONDITIONS WITH A DOUGLAS DC-9, A (NASA) G3/09

N77-27133

Unclas 35500

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PRELIMINARY TEST RESULTS OF THE JOINT FAA-USAF-NASA RUNWAY RESEARCH PROGRAM, PART II - TRACTION MEASUREMENTS OF SEVERAL RUNWAYS UNDER WET, SNOW COVERED, AND DRY CONDITIONS WITH A DOUGLAS DC-9, A DIAGONAL-BRAKED VEHICLE, AND A MU-METER

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1.0 INTRODUCTION

1.1 General - Since the beginning of modern all weather aircraft operations, there have been landing incidents and/or accidents each year where aircraft have either run off the end or veered off the side of wet or slippery runways. These incidents/accidents have provided the motivation for various government agencies to conduct research into the causative factors involved in slippery runway incidents.

1.2 Background - [illegible] and Space Administration (NASA), Federal Aviation Administration (FAA), United States Air Force (USAF) [illegible] braking friction does [illegible] surface and the degree of friction reduction is related to [illegible] surface, surface texture, [illegible] Much of the research effort has been utilized to establish an understanding of mechanisms associated with the slipperiness problem. In 1968, a number of friction measuring vehicles were tested at NASA Wallops Station, Virginia, to ascertain the suitability of the various vehicles for measuring friction in a repeatable manner and for providing an index that might be correlated with aircraft stopping performance and/or used to produce information which could be used as an operational guide to pilots during inclement weather conditions (ref. 1). As a result of these and subsequent tests, two ground vehicle measuring methods emerged, each showing promise of correlating with aircraft stopping performance and each showing capability of becoming the basis for an operational technique. The two methods are the NASA diagonal-braked vehicle (DBV) and the British Mu-Meter. Although testing to date has produced data which indicate reasonable correlation may exist between these vehicles and some aircraft, sufficient experimental data has not been obtained to show that such correlation would apply over the range of operational aircraft types and slipperiness conditions likely to be encountered in scheduled air carrier operations.

1.3 Joint FAA-USAF-NASA Runway Research Program - In order to establish further the degree of stopping distance correlation that might be obtained between modern jet transports and ground friction measurement vehicles over a wide range of slipperiness conditions, the FAA, USAF, and NASA are conducting a "Joint FAA-USAF-NASA Runway Research Program."

> Phase I - Two modern jet transports have been tested along with the diagonal-braked vehicle and Mu-Meter on several runways which when wetted cover the range of slipperiness likely to be encountered in the United States. These tests were designed to determine if correlation between the aircraft and friction measuring vehicles exists.
>
> Phase II - A computer study of several modern civil/military jet aircraft anti-skid braking systems will be conducted to ascertain which parameters have major influences in aircraft/ground vehicle correlation.

The program was designed to validate the adequacy of the existing techniques or to identify the need to proceed in the further development of ground friction measuring vehicles.

1.4 Test Team - The tests of the first airplane in Phase I, a Boeing 727, were conducted during the period of October 4-16, 1971, (NASA LWP-1016). The tests of the second airplane in Phase I, a Douglas DC-9, were conducted during the period of February 18-25, 1972. The test team consisted of members of the three government agencies, and representatives from the following industry organizations and foreign governments: The Boeing Company; The Douglas Aircraft Company; Aerospace Industries Association; Air Transport Association; United Airlines; Air Line Pilots Association; Ministry of Transport, Canada; Ministry of Defense and Air Registration Board, United Kingdom; Centre D'Essais En Vol, Bretigny, France; M. L. Aviation Ltd., United Kingdom; and Hydroaire, Inc. In addition, at several of the test sites, observers from other organizations, such as Airport Operators Council, Inc., etc., were present.

1.5 Logistics - Logistics support for the DC-9 tests was provided initially by a USAF C-141 and later by two USAF C-130 aircraft. These aircraft transported the two ground vehicles, spare wheels and tires for the test aircraft and DBV, runway markers and miscellaneous measuring equipment, and the USAF and Douglas portable phototheodolites. The test crew and test aircraft instrumentation spares were transported between test sites on the DC-9 test aircraft. A test crew of 36 people was necessary for the efficient conduct of the DC-9 test program.

1.6 Purpose - This paper presents the preliminary data obtained from the DC-9 aircraft, diagonal-braked vehicle, and Mu-Meter tests conducted in February 1972.

2.0 TEST EQUIPMENT

2.1 Aircraft - The second Phase I test airplane was a Douglas DC-9-15 jet transport with two rear mounted jet engines depicted in Figure 1(a). The maximum authorized landing weight for the airplane tested is 81,700 pounds using full landing flaps. Maximum brake application speeds varied, according to weight from 129.3 to 100.1 knots. The test landing brake energy range varied from a WV^2 of 7.13×10^8 lb-kt^2 to 13.73×10^8 lb-kt^2. Some taxi tests at lower energies were conducted.

2.1.1 During the time period when the aircraft was being instrumented at the NASA Langley Research Center, the anti-skid control valves, skid detectors, and MARK II anti-skid control box were removed from the aircraft and sent to the manufacturer for inspection and functional test. Components were checked for proper operation, refurbished as necessary, and were returned to Langley for installation on the test aircraft. This check was made to insure that the aircraft anti-skid components were within specified tolerances and near peak performance for the flight test program to follow. During re-installation and checkout of the MARK II anti-skid control box on the test airplane, a discrepancy developed in the control box circuitry. A spare MARK II control box had

to be substituted and was used for the test program. The substitute MARK II control box was sent to the Manufacturer for the factory functional test after the test program was completed and was found to be within factory specifications.

2.1.2 Stopping distance, brake pressure, velocity, and time of brake application were the principal measurements required to evaluate the aircraft stopping performance. The instrumentation which was used to measure these principal parameters is listed in table I. Included in the table are additional items which were instrumented in order to provide data relative to the anti-skid braking system and other aircraft characteristics necessary for a thorough evaluation of the stopping performance. Two test instruments, a nose wheel counter and the Douglas and USAF photographic systems were used to record the principal parameters to insure complete and accurate acquisition of these items. A signal block diagram of the instrumentation listed in table I is shown in figure 2. The accuracy of each of the instrument sensors is listed in table II for the oscillograph system and in table IV for the magnetic tape system. Figure 3 shows the main instrumentation rack and figure 4 shows the Aldis lamp installed on board the DC-9 aircraft which was actuated at brake application. The light was used or a reference for the ground photo-theodolites.

2.1.3 The nose wheel counter consisted of two magnetic pickups mounted on the nose strut of the aircraft, a ring with 160 segments and two small steel masses mounted 180° apart on the right hand nose wheel, figure 5(a). The signals generated by the segmented ring produced a ground speed output which was displayed visually in the cockpit, figure 5(b) and fed to a magnetic tape channel for permanent recording. The distance signals generated as each of the two steel masses passed the pickup were fed to a digital counter in the cockpit, figure 6, and to a magnetic tape channel for permanent recording.

2.2 Diagonal-Braked Vehicle, DBV - The diagonal-braked vehicle is a 1969 Ford XL sedan with a high performance engine for rapid acceleration to the test speed of 60 mph. This vehicle is equipped with a diagonal braking system to maintain vehicle stability and directional control when the diagonal wheels are locked at high speed. The diagonal-braked wheels are fitted with ASTM smooth tread test tires (specification E-249) inflated to 24 psi. The unbraked wheels are equipped with standard road tires of good tread design inflated to 32 psi. The trucking wheel tire is maintained at 28 psi inflation pressure. The vehicle is shown in figure 1(b). A schematic diagram of the diagonal braking system is shown in figure 7.

2.2.1 The stopping distance, speed, and acceleration instrumentation on board the DBV is listed in table IV. The key elements of instrumentation are depicted in figure 8. Figure 9 shows typical DBV recorder traces for test runs conducted on dry and wet runway surfaces. The key parameter changes between the dry and wet conditions are the longitudinal acceleration and the time required for the DBV to stop. For the wet condition, the reduced longitudinal acceleration causes the increase in time and stopping distance over that of the dry case. The primary brake application speed and stopping distance measurements used in the analysis of this report are variables 4 and 5,

respectively of table IV which are obtained from NASA standard instruments. The stopping distance instrumentation was calibrated by driving the DBV over a 1000-foot measured distance on a straight airport taxiway or on the runway test section.

2.3 Mu-Meter - The Mu-Meter is a side force measuring trailer shown pictorially and graphically in figures 10 and 11. The total weight of the trailer is approximately 530 pounds. It may be towed by an automobile or light truck when equipped with a suitable towing hitch.

2.3.1 The Mu-Meter instrumentation consists of a chart recorder, figure 12, driven by the rear center wheel. The chart speed is arranged such that 1 inch on the chart is equal to approximately 450 feet of runway length. The chart recorder has two channels: one for recording the side force friction reading, hereafter referred to as friction reading, scale 0 - 1.0, and the other for use as an event marker, bulb operated. Figure 13 shows the Mu-Meter chart traces made on the dry runway, at Lubbock and before and after aircraft run 47 on the same runway after artificial wetting. The Mu-Meter friction reading is calibrated according to the instruction manual (Ref 2) by means of a friction board having a standard surface texture provided with the Mu-Meter. The tires that measure the side force must be inflated to 10 psi. The tire driving the recorder must be inflated to 30 psi. The Mu-Meter used in these tests was also fitted with a remote reading unit which provided an integrated average friction reading over the entire surface tested.

2.4 Wetting Equipment - The equipment used for artificially wetting the runways varied from airport to airport, but generally consisted of from one to three tank trucks varying in capacity from 3000 gallons to 8000 gallons. Most of these vehicles used a pump to discharge the water at rates varying from 500 to 1600 gallons per minute in order to get the maximum amount of water on the test section in a given time interval. A typical tanker truck wetting operation is shown in figure 14.

2.5 Miscellaneous Equipment - Miscellaneous test equipment consisted of runway markers, figure 15, to identify the test section, NASA water depth gages, (Ref 3) figure 16, for measuring water depth, a surface texture depth kit, (Ref 3) figure 17, and miscellaneous data gathering equipment including a portable anemometer, Rolatape, thermo-electric temperature gage and a portable psychrometer. A USAF portable phototheodolite and a Douglas portable phototheodolite, figure 18, which were set up approximately 1000 feet perpendicular to the runway centerline at the approximate midpoint of the runway test section were used to record aircraft and DBV stopping distances.

3.0 TEST PROCEDURES

3.1 Test Sequence - Two basic test sequences were used - one for dry surface tests and one for wet surface tests.

3.1.1 For the dry surface conditions, the DBV and the Mu-Meter generally made their initial tests prior to the first aircraft stopping distance test. On occasion, a second series of dry tests with the ground vehicles was made while the aircraft was down for refueling.

3.1.2 For the wet surface conditions, the test sequence used is summarized as follows:

1. Water tankers wetted the runway test section in two continuous passes.

2. Water depth measurements were made at each measuring station immediately after the second pass of the water tanker and before the initial ground vehicle runs.

3. Initial ground vehicle measurements were made.

4. Aircraft landed and stopped.

5. Water depth measurements were made at each measuring station.

6. Second ground vehicle measurements were made.

7. Water depth measurements were made at each measuring station.

3.2 Wetting Procedure - Artificial wetting of the runway test section was accomplished using from two to three water tankers. The rate at which water was discharged from the tankers was used to establish the speed of the vehicles so that all water was expended at the end of the second pass down the test section. The tankers made the initial wetting pass in a direction opposite to that of the landing aircraft and a second pass in a direction the same as that of the landing aircraft. The center 40 to 50 feet of the runway test section was wetted. The time to wet the test section for each wet test and the amount of water used is listed in table V.

3.3 Water Depth and Atmospheric Data Measurements - Water depth measurements were made at six stations (runway markers A through G) spaced down the length of the test section as shown in figure 19. Measurements of water depth were made at each station using the NASA portable water depth gage. These measurements were made on and at 10 feet either side of the runway centerline. The first measurements were made immediately after the water tankers passed each station on the second wetting pass. The second set of measurements were made after the aircraft landing and stop and the third set of measurements were made after the final ground vehicle runs. The average water depths at the time of aircraft stopping test is shown for each test in table V. Table VI presents the average water depth as a function of time relative to the aircraft test. The average water depths in table V were obtained by plotting the data of table VI.

3.3.1 Atmospheric data, consisting of wet and dry bulb temperatures, relative humidity, wind speed and direction, barometric pressure and runway surface temperature were taken at the time of each aircraft test. These data are listed in table V.

3.4 Aircraft Test Procedure - For maximum braking stops, the aircraft was landed short of the test section at a speed sufficiently in excess of the desired brake application speed so that the nose wheel could be placed on the ground, the wing lift spoilers could be raised and the engines could be spooled down to idle rpm (approximately 5 seconds spool down time) by the time the threshold of the test section was reached. Upon entering the test section, maximum brakes were promptly applied and held in the maximum "ON" position until the airplane came to a complete stop. An exception to this procedure was required in case the aircraft exited the wetted test section with wheels locked. The pilot was instructed to release the brakes upon exiting the wetted test section and reapply brakes to stop on the dry surface. On three occasions the aircraft exited the wetted test section prior to stopping, necessitating the release and reapplication of brakes as the transition from wet to dry surface was made. This procedure was followed even though, for these runs, the main wheels did not lock up while in the wet section. The procedure was designed to prevent excessive flat spotting in case locked wheels had occurred and the airplane transitioned from a wet to a dry surface with wheels locked. A correction to the stopping distance was necessary as a result of using this procedure. The correction is described in paragraph 4.1.4.

3.5 DBV Test Procedure - The diagonal-braked vehicle was operated in accordance with the following procedures: The car is accelerated to approximately 65 mph prior to reaching the test section, the transmission is then placed in neutral at a point which will result in a speed of 60 mph being attained at the point of entry into the test section. Upon entering the test section, maximum brakes are applied, locking the two diagonal-braked wheels which are equipped with the ASTM smooth tread tires. No braking torque is applied to the other two wheels which are free rolling to provide directional control. Maximum brakes are held "ON" until the car has come to a complete stop. Two, and sometimes three, stops were made within the length of the test section. Where only two stops were possible, other segments of the test section were measured on subsequent aircraft tests, if needed. Basic DBV data for the dry surface tests are included in table VII, and data for wet surface tests are included in table VIII. Table VIII shows the test results in relation to the time of the aircraft test.

3.6 Mu-Meter Test Procedure - The Mu-Meter was operated in accordance with procedures developed in the United Kingdom (ref. 7). For each run the towing vehicle was accelerated to the selected towing velocity, usually 40 mph, prior to entering the test section. This velocity was held constant for the run through the test section. Some data were also obtained at speeds other than 40 mph. The basic Mu-Meter data for the dry surface conditions are included in table VII and the basic wet surface data are included in table VIII. The latter is shown in a time relationship to the aircraft test.

4.0 DATA REDUCTION PROCEDURES

4.1 Aircraft - The nose wheel revolution counter (2 pulses/revolution) and ground speed meter were installed in the cockpit of the test aircraft (See figures 5 and 6) to provide "quick-look" capability in the field for measuring aircraft stopping distance and ground speed from the point of

brake application. In order to obtain the appropriate calibration factors for these instruments several calibration runs (runs 1 through 5) were made at NASA Wallops Station to establish an accurate nose wheel tire rolling radius. These initial calibration runs were later supplemented with similar runs at Edwards AFB and at Edmonton International Airport. Calibration factors obtained from the calibration runs were used to obtain the "quick-look" brake application ground speed and stopping distance (from brake application) values listed for the aircraft test runs in Table V.

4.1.1 It must be emphasized that the values of aircraft stopping distance and brake application speed listed in Table V were subject to possible reading or recording errors by the flight crew and it was also possible that spurious counts could have been generated if the pilot partially engaged the brakes prior to applying full brake pedal deflection upon entry into the test section. Thus, during the data reduction process the magnetic analog tape records of all aircraft calibration and test runs were analyzed to validate the nose wheel "quick-look" data given in Table V. Figure 20 shows the variation of feet per nose wheel count with aircraft ground speed. An average nose wheel tire rolling radius of 1.0218 feet over the test ground speed range was determined. This results in a calibrated nose wheel tire circumference of 6.42 feet. These data were used as described in 4.1.2 and 4.1.3 below.

4.1.2 The aircraft ground speed at brake application was determined in two ways to insure accuracy and to provide a check against possible errors in the data reduction process. In the first case the number of nose wheel pulses obtained from the nose wheel distance counter, taken from an analog print out of the magnetic tape record, were counted over several seconds just before and after brake application. The pulses per second were converted to nose wheel revolutions per second (i.e., 2 pulses per revolution) and thence to aircraft velocity in accordance with equation (1). The results were plotted against time and the aircraft speed at the time of brake application was determined from this plot. In the second case the magnetic tape recording of the nose wheel velocity pulses (160 per revolution) was processed to produce a digital readout against time and the number of nose wheel revolutions per second occurring at the time of brake application was used to obtain the ground speed at brake application as follows:

$$V_{Bg} = \frac{N \times 6.42}{1.689} = 3.801\ N \qquad (1)$$

where

V_{Bg} = brake application ground speed in knots
N = nose wheel revolutions per second
6.42 = calibrated circumference of the nose wheel tire, feet
1.689 = factor to convert feet per second to knots

The two methods yielded results that were, in general, within one knot of each other. The velocities obtained from the nose wheel velocity pulses are used in this paper.

4.1.3 The aircraft stopping distance from the nose wheel counter was

determined in similar fashion by hand counting the number of nose wheel pulses from brake application speed to a complete stop from the magnetic analog tape test records and by use of the equation:

$$S_B = \frac{2\pi r_e N}{6} = .1047 r_e N \quad (2)$$

where

S_B = stopping distance, feet
r_e = 1.6218 feet
N = number of nose wheel pulses (6/revolution)

The values of brake application ground speed and aircraft stopping distance obtained by these data reduction techniques from the nose wheel instrumentation measurements are listed in Table IX, and are the data points which should be used in any analysis.

4.1.4 In three instances the aircraft exited the wetted test section before coming to a complete stop. In two of these instances, Runs 44 and 56 at Lubbock, the distance remaining to stop from the end of the test section and from the test section exit speed, had the wet runway been available, was determined by examining the plots of figures 21(b), and 21(c). It can be seen from these graphs that at the lower speeds the data from all wet runs merge and follow a common fairing to the stop point. Thus for runs 44 and 56 the appropriate curve was entered at a value corresponding to the exit ground speed squared and the distance obtained was added to the distance from the brake application point to the end of the wetted test section to obtain the total distance. Run 66 at Edwards had the wing spoilers retracted and was not corrected for actual stopping distance. The value shown in Table IX represents the length of wetted test section traversed from brake application point to exit point.

4.1.5 Douglas Aircraft Company processed and reduced the test film acquired by its phototheodolite during the test program using standard Douglas film data processing procedures. Values of brake application ground speed and aircraft stopping distance obtained by this theodolite are also listed in table IX.

4.1.6 At Edwards AFB, the USAF obtained measurements of aircraft brake application speed and stopping distance during wet runs from data obtained by operating its fixed (tower) ground phototheodolite equipment. This was in addition to data acquired at each test runway be operating its portable ground phototheodolite during test runs. The measurements of aircraft brake application speed and braking distance obtained by the Edwards ground phototheodolite are presented along with the NASA nose wheel counter and Douglas phototheodolite instrumentation in table X. It can be seen from this table that the USAF data for speed and distance are in good agreement with the NASA and Douglas data obtained at Edwards AFB. Data obtained by the USAF portable phototheodolite during the test program are still being reduced by USAF and, therefore, are not available for incorporation in this paper.

4.1.7 Observers stationed along the runway noted the points on the runway during each test run where an Aldis lamp mounted in the cabin of the airplane (electrically coupled to the pilot's brake pedals) was turned "ON" and "OFF" by pilot brake application. The distance between the brake application and aircraft stop points along the runway were measured and noted in tables V and IX. This was a backup quick-look method for measuring aircraft braking distance and is not considered accurate.

4.1.8 In response to questions regarding methods of data presentation for the B-727 in LWP-101, the aircraft stopping distance data have been reduced by three different methods in this paper to determine the effects of these various methods on comparisons with the DBV and Mu-Meter data. The WV^2, or energy method, of displaying the test data is the preferred method of one large aircraft manufacturer while the V^2 method of presentation is preferred by another large aircraft manufacturer. In addition, Douglas data reduction equations were used to correct the aircraft test data to standard weight, sea level, and zero wind conditions. This method labeled S_{ew}/V^2_{ew} was employed in order to assess the effects of variables such as airport altitude, aircraft gross weight and wind on aircraft/ground vehicle correlation. Each of these reduction methods is discussed separately in the following paragraphs.

4.1.8.1 The WV^2_{Bg} method involves plotting the dry stopping distance at all test sites against airplane energy at brake application which is represented by the term WV^2_{Bg}, where V_{Bg} is the brake application speed in knots and W is the aircraft weight in pounds. These plots are then used to obtain the aircraft wet/dry stopping distance ratio in the following manner. The aircraft dry stopping distance is determined from the faired line of figure 21 for the value of WV^2_{Bg} associated with the wet run being examined and that distance is then divided into the measured wet distance to obtain the aircraft SDR. Figure 22 shows the nose wheel counter and Douglas phototheodolite data plotted for both the Mark II and Mark IIIA antiskid braking systems, maximum braking only, and for the cases where reverse thrust was used together with maximum braking to stop the aircraft. The data were obtained from Table IX. The data scatter is attributed principally to differences in airport altitude, runway surface texture, atmospheric conditions and antiskid braking system performance between the different test runs. The faired nose wheel counter data give the aircraft a shorter dry stopping distance for a given WV^2_{BG} than the Douglas data. The reason for this difference may be determined from examination of figure 23. In general, the Douglas phototheodolite yields shorter stopping distances and lower velocities than the NASA instrumentation. Since the velocity term is squared it becomes the dominant factor in the difference of the slope of the faired lines of figures 22(a) and 22(d), for example. A brief investigation into the differences in distance and velocity between the two measuring systems does not yield a full explanation. In the case of the nose wheel counter, calibration runs were made at Wallops, Edwards, and Edmonton. The results are shown in figure 20. In the case of the Douglas phototheodolite, it is noted that the majority of the velocity points that are lower than the nose wheel counter points result from data obtained when the angle between the aircraft centerline and the camera is small, thus subjecting the results to more error than if the angle were larger. Additional analysis is required to determine the reason for these differences.

As shown in figure 23, the SDR's determined from Douglas phototheodolite data generally tend to be somewhat lower than aircraft SDR calculated from NASA counter data. Because of general agreement shown between NASA counter data and Edwards phototheodolite data(see table X)the NASA counter data is used exclusively in the data analyses.

4.1.8.2 The second method used to evaluate the aircraft stopping performance utilizes plots of stopping distance versus [illegible]. This method stems from the fact that, in the simplest form, the energy equations applied to aircraft stopping distance are:

$$\frac{1}{2}MV^2 = F_D S = \mu_g S$$

where M = Mass

V = Velocity, fps.

g = 32.174 ft/sec^2

μ = friction coefficient

S = Stopping distance

F_D = Decelerating force, lb.

Thus $S = \frac{V^2}{2\mu g}$ showing that stopping distance is directly proportional to V^2. The test data were, therefore, plotted in this fashion in figure 24. The fairing of the curve through the data points was influenced by the shape of the individual runs shown in figure 21 which show that at the lower values of V_{Bg}, the dry stopping distance data is independent of weight effects. The data scatter is influenced by the same factors which were identified in 4.1.8.1. The plots are used in the same manner as the WV^2_{Bg} plots to determine the aircraft SDR.

4.1.8.3 The third reduction method used follows the Douglas Aircraft Co. procedure of reducing aircraft flight test data to sea level, zero wind, standard weight conditions. The following equations were used:

$$S_{ew} = \left(S_g + V_w t_g + \frac{1}{2} a_w t_g^2 + \frac{V_w (V_g + a_w t_g)}{g} \right) \frac{W_g}{W} \qquad (3)$$

where

S_{ew} = stopping distance at sea level, zero wind, standard weight W_g, feet

S_g = actual test stopping distance, feet

V_w = wind velocity parallel to the airplane centerline (+ head wind, -tail wind), feet per second

t_f = time from brake application to stop, seconds

$\Delta t = \frac{V_w}{dV/dt}$ where $\frac{dV}{dt}$ = slope of the aircraft velocity/time curve at stop, seconds

γ = runway slope

g = 32.174 ft/sec^2

W_S = aircraft standard weight = 50,000 pounds

W = aircraft test weight, pounds

$$V_{ew} = (V_g + V_w)\sqrt{\sigma}\sqrt{\frac{W_S}{W}} \qquad (4)$$

where

V_{ew} = aircraft airspeed at S.L., Std wt.

V_g = ground speed, feet per second

V_w = wind velocity parallel to the airplane centerline (+ head wind,- tail wind), feet per second

σ = air density ratio

W_S = aircraft standard weight = 50,000 pounds

W = aircraft test weight, pounds

Since the runway test sections involved in these tests had minimal runway slopes the contribution to stopping distance of the slope term was neglected. The resulting S_{ew} versus V^2_{ew} plots are shown in Figure 20. The scatter of the data thus produced is seen to be similar to that of figure 24(a) in the case of the Mark II antiskid system, but considerably more than figure 24(b) in the case of the Mark IIIA antiskid system. Again, these plots are used in the same manner as previously described to determine the aircraft SDR.

4.1.9 In order to determine the consistency with which the aircraft stopped on the various wet and dry surfaces, plots of stopping distance versus V_g^2 were made from brake application down to a stop. The data for these plots, figure 21, were obtained from the nose wheel counter magnetic tape records which were digitized using standard NASA computer processes. Data points were obtained at one and two second intervals and the nose wheel distance and velocity pulses were converted into velocity and distance in

accordance with the equations (1) and (2).

4.1.9.1 Examination of the plotted data of figure 61 shows that the test aircraft performed in a very consistent manner on the dry surfaces in that after the antiskid system had stabilized the stopping distance versus V_G^2 plots coincided. In order to answer a question raised in the variation of aircraft stopping distance with speed an examination was made using the data plots of figure [illegible] to calculate aircraft two-point stopping distance ratios at various speeds, again assuming that the aircraft was in a stabilized braking mode. The results were presented in figure [illegible] and show that there is but a small variation in SDR over the normal initial speed range of from 1.2 V_{STALL} down to $V_{[illegible]}$. The maximum range of initial brake application speed shown in figure [illegible] indicates the minimum as $V_{[illegible]}$ at a typical pound weight and the maximum as [illegible] $V_{[illegible]}$ at the maximum certificated landing weight of 81,700 pounds. The plots of figure [illegible] were extended to lower speeds to determine the speeds at which the SDR's begin to depart significantly from those values experienced in the normal range of initial braking speeds.

4.1.10 Data which were recorded on the magnetic analog tape were digitized, converted to engineering units, and displayed in the form of time history plots. In addition to these time histories, a braking coefficient of friction has been computed as a function of time from the taped records of longitudinal acceleration and nose wheel velocity. In this computation nominal values of the aerodynamic coefficients for the aircraft in normal braking configuration and engine idle thrust have been used. The equation used for the computation of the braking coefficient of friction was derived from considerations of the longitudinal equation of motion and the equilibrium relations in both the vertical direction and about the pitch axis of the airplane. The equation is shown below:

$$\mu = \frac{(x_M - x_N)\left[(C_L - C_D)qS_w + \left[\cos\beta - \mu_B \sin\beta\right]T\right.}{\left.-\left[\left(\frac{\ddot{x}}{g} + \sin\gamma\right) + \mu_B \cos\gamma\right]W\right\}}$$

$$x\,C_L\bar{c} + (x_N - x_{ac})C_L - z_{ac}C_D)qS_w$$

$$+\left[\left(\frac{\ddot{x}}{g} + \sin\gamma\right) + (x_{cg} - x_N)\cos\gamma\right]W$$

$$+\left[(x_T - x_N)\sin\beta - z_T\cos\beta\right]T \qquad (3)$$

where $q = 1/2\rho(V_w + r_o w_N)^2$

and C_D = aerodynamic drag coefficient

C_L = aerodynamic lift coefficient

C_M = aerodynamic moment coefficient

$\bar{c}$ = wing reference chord length

g = acceleration of gravity

q = dynamic pressure

r_o = nose wheel rolling radius

S_w = wing reference area

V_w = wind velocity

W = aircraft weight

x = measured aircraft acceleration

x_{ac} = longitudinal position of aerodynamic center

x_{cg} = longitudinal position of aircraft center of gravity

x_M = longitudinal position of main wheel

x_N = longitudinal position of nose wheel

x_T = longitudinal position of thrust vector

z_{ac} = height of aerodynamic center above the ground

z_T = height of effective thrust vector above the ground

β = thrust vector angle to horizontal

γ = runway slope

μ = braking coefficient of friction

μ_r = rolling wheel coefficient of friction

ρ = atmospheric density

T = engine thrust

ω_N = nose wheel rotational speed

4.1.11 During the course of examining the DC-9 aircraft test data it became apparent that the slip ratio developed by the braked main gear wheels differed considerably from that experienced on the [illegible] aircraft. Consequently the DC-9 main wheel slip ratio as a function of braking speed was investigated. From the digitized magnetic tape data, free rolling velocities of the main and nose wheels were obtained and are plotted in figure 27. This figure shows that the ratio of main wheel angular velocity to nose wheel angular velocity varies linearly over the speed range from brake application to stop. This ratio was determined to be 0.67 from the test data. This value was also determined by dividing the average unloaded nose wheel diameter 25.40 inches, (26x6.6 tire) by the average unloaded main gear diameter, 39.32 inches (40x14 tire) which gives a ratio of 0.646. The test calibration constant was used in processing the data to determine the synchronous angular velocity of the main gear wheels by:

$$-\omega_{M_S} = \omega_N \times 0.67 \qquad (6)$$

and the slip ratio of the braked main gear wheels is determined from:

$$\text{Slip ratio} = \frac{\omega_{M_S} - \omega_{M_A}}{\omega_{M_S}} \qquad (7)$$

where:

ω_{M_S} = main wheel synchronous (unbraked) angular velocity in rps.

ω_{M_A} = main wheel angular velocity in the braked condition, rps.

Using equations (6) and (7), main wheel slip ratios were computed and are presented as a part of the time history plots in the Appendix. Three examples are shown in Figure 28 where it can be easily seen that the slip ratios at the higher speeds are of the order of 0.1 or less. Included in the appendix, in conjunction with the main wheel slip ratios, are plots of the effective braking friction coefficient which may be used along with the slip ratios to assess the operation of the aircraft antiskid braking system performance during the stopping tests.

4.1.12 In looking for methods to provide a meaningful comparison of the aircraft and ground vehicle results it was decided that a determination of the average friction realized by the aircraft during a stop might show a meaningful relationship to the average friction coefficient realized by the DBV during its stop and the average Mu-Meter reading. Accordingly the

aircraft stopping distances (nose wheel counter data) from table IX were reduced to an average friction coefficient by use of the equation:

$$\mu_{avg} = \frac{V_{Bg}^2}{2gS} \qquad (8)$$

where

μ_{avg} = average friction coefficient realized during the aircraft stop

V_{Bg} = brake application ground speed, fps.

g = 32.174

S = measured stopping distance, ft.

These data are plotted in figure 29.

4.2 Diagonal-Braked Vehicle (DBV) – The DBV test technique is to apply brakes at 60 miles per hour and measure the stopping distance required to brake the vehicle to zero speed. Two independent measuring systems operating from the same trailing fifth wheel on the test vehicle were used in a redundant manner to obtain values of brake application speed and stopping distance. The values of speed and distance obtained by the two measuring systems, one labeled NASA and one labeled prototype, during DBV dry runway tests are listed in table VII and the values obtained from wet runway tests are listed in table VIII. Data obtained by the NASA system are used in this report since the prototype unit developed problems in its regulated power supply. Subsequent to the test program it has been established that when the regulated power supply of the prototype system was redesigned to split the load a more uniform set of results could be obtained. Further evaluation of this "low cost" unit has been made in other tests conducted by the FAA which have proven the satisfactory nature of the power supply redesign.

4.2.1 The NASA developed correlation technique between aircraft and DBV requires that the DBV stopping distance ratio, wet/dry, be made on a 60-mph brake application speed base. This requirement necessitated normalizing the DBV stopping distances shown in tables VII and VIII to an equivalent 60-mph brake application speed. Since the stopping distance is known to be dependent upon the kinetic energy, which is a function of V^2, the correction equation to be used when the brake application speed differs from exactly 60 mph is

$$S_{60} = \frac{V_{60}^2}{V_{Test}^2} S_{Test} \qquad (9)$$

where

S_{60} = DBV stopping distance from 60 mph, ft

S_{Test} = DBV test stopping distance, ft

V_{Test} = DBV test brake application speed, mph

V_{60} = correlation brake application speed = 60 mph

In order to establish the range of validity of the use of this equation, a series of tests was conducted at NACA Wallops Station on February 8-11, 1972, where two DBV's were tested at speeds from 30- 6 mph. Correction to 60 mph, using the V^2 equation, from each speed was made. The results are shown in figure 29(a). Figures 29(a) and 29(b) indicate that data obtained on dry surfaces and on flare ice at speeds as low as 30 mph may be satisfactorily corrected to 60 mph without significant error.

4.2.2 The friction coefficient developed by rubber sliding on runways or other paved surfaces may be affected by the initial rubber temperature at the start of sliding and the incremental increase in the rubber surface temperature due to the skidding energy developed during the period of time that the tire is sliding. It was noted in reference 3 that the DBV dry stopping distance appeared to vary with ambient air temperature in accordance with the equation:

$$S_D = 203 + 1.4^{\circ}T \qquad (10)$$

where

S_D = DBV dry stopping distance, feet

T = ambient air temperature, °F.

Since the time of the tests from which equation (10) was established there have been numerous other tests which have produced data for consideration in evaluating this phenomenon. These data are shown in Tables XI through XIV and have been examined to ascertain potential trends by plotting as shown in figure 31. The plot of figure 31 was subjected to an averaging, first at constant temperature, then for 5° temperature increments to obtain figure 32 which indicates that there is no significant change of dry stopping distance with temperature over the range of temperatures tested. There does appear to be a slight upward trend beyond 65° F. and for this reason the fairing of figure 32 was used in determining DBV dry stopping distance data in this paper for use with wet stopping distances to compute the DBV SLR.

4.2.3 To understand why the data produce a value at the lower temperatures that is higher than that shown in reference 3, the effect of friction coefficient, μ, on stopping distance of the DBV was examined. Evaluating the basic stopping distance equation:

$$\Delta S_D = \frac{V_1^2 - V_2^2}{2a} \qquad (11)$$

where

ΔS_D = incremental stopping distance

V_1^2 = brake application speed, squared

V_2^2 = any speed less than V_1, squared (V_2 = 0 for the complete stop case)

$a = \frac{g}{W}\left(\mu\frac{W}{2} + D\right)$ since only two wheels are locked

$D = \frac{\rho}{2} S V^2 C_D$

V^2 = air velocity

C_D = 0.55 (from chapter 12, "Fluid Dynamic Drag," by Dr. Ing. S. F. Hoerner)

S = 20 ft^2 (frontal area of a modern full size sedan automobile)

ρ = air density, lb/ft^3

the plot of figure 33 was obtained which shows that:

1. The minimum stopping distance which can be realized by the DBV with μ = 1.0 is 230 feet.

2. The average dry stopping distance obtained from test data on numerous runways is the result of an average friction coefficient, μ = 0.77 being developed between the sliding tire and the runway surface over the temperature range of 0° to 65° F.

As stated in 4.2.3 fairing of figure 33 was used in this paper for purposes of determining the DBV stopping distance ratios, wet/dry. A review of the B-727 data which is contained in NASA LWP-1014 has been made to determine if the DBV SDR's obtained in that report should be changed. It was determined that since [illegible] of the DBV dry data gathered during the B-727 tests were obtained at temperatures above 40° F, little or no practical error would be introduced if either curve were used. (See figure 34). Thus it has been determined that no changes are required to the DBV SDR's obtained during the B-727 tests.

4.2.4 As can be seen in table VIII, the DBV stopping distances as well as the Mu-Meter average friction readings vary considerably with the time of test following the artificial wetting of the runway. These variations with time are due to vehicle activity or water drainage from the surface which reduces the effective water depth at the time of the test. Thus, for correlation between aircraft and the ground vehicle runway slipperiness measurements the data must be time correlated with the aircraft data for any given aircraft test on an artificially wetted runway. The procedure employed in this paper

for time-correlating the aircraft, ground vehicle, and runway water depth data is illustrated in figure 35. In this figure, the DBV stopping distance data obtained from table VIII for run 47 has been normalized to a 60-mph base using equation (9). These corrected stopping distance data were then plotted against the time from aircraft run data, also obtained from table VIII. In this way, it is possible to obtain an interpolated value of DBV wet stopping distance at the time of aircraft run that reflects the same runway slipperiness condition as encountered by the aircraft. The DBV d/r (wet/dry stopping distance ratio) time correlated to each aircraft run was obtained by dividing the wet DBV stopping distance by the dry stopping distance at the same ambient air temperature as for the wet run in accordance with the curve of figure 32.

4.2.5 The average friction coefficients realized by the DBV in stopping from a 60 mph brake application speed were computed for comparison with the similar value for the aircraft in figure 29. The equation used is:

$$\mu_{avg} = \frac{V^2}{2gS} = \frac{120}{S} \qquad (12)$$

where

μ_{avg} = average friction coefficient realized by the DBV during a stop

V = 88 fps

g = 32.174

S = measured stopping distance, feet

The dry stopping distance data for each airport was obtained from Table VII, corrected by equation (9) and the number of points available at each airport were used to obtain an average value which was, in turn, used in equation (12). The wet DBV stopping distances used are the time correlated values found in table IX.

4.3 Mu-Meter - The Mu-Meter was towed at constant speed (usually 40 mph) over the section of the runway to be measured. In addition to the test speed of 40 mph, some runs in this investigation were made with the Mu-Meter at speeds of 20 and 30 mph to obtain data on the effect of speed on Mu-Meter readings on a snow-covered surface. Typical test records obtained with the Mu-Meter before and after aircraft run 47 are shown in figure 13. The Mu-Meter instrumentation included a remote mechanical integrator which automatically read out an average friction reading for the length of test section measured by the Mu-Meter. The integrator average friction reading obtained for each test run of the Mu-Meter is listed in table VIII. For most aircraft runs, the aircraft did not required the full runway test section length to come to a complete stop. Consequently, the Mu-Meter test records were analyzed only over the portion of the test section (see figure 13) in which the aircraft test occurred. In this manner, the average, maximum, and minimum friction readings of the Mu-Meter were obtained for the length of the

runway test section associated with the aircraft test. These Mu-Meter average record friction readings for each test run are also listed in table VIII.

4.3.1 The Mu-Meter average friction reading at 40 mph obtained from the record was time-correlated with aircraft test run 47 as shown in figure 35. In this figure, the Mu-Meter average friction reading at 40 mph, taken before and after the aircraft test run, was plotted against time from aircraft run data obtained from table VIII. All of the Mu-Meter test runs made at 40 mph test speed were analyzed in this manner and the time-correlated Mu-Meter average friction readings are listed in table IX. Figure 36 presents data on two ice covered surfaces at Wallops and shows that there is essentially no difference in Mu-Meter readings from 20 to 50 mph.

4.3.2 Operation of the Mu-Meter on snow-covered surfaces at Edmonton was not entirely satisfactory in that the Mu-Meter produced a side-to-side instability which tended to invalidate any readings. The manufacturer attributes the instability encountered to the fact that a smooth tread center tire was used instead of a block tread tire. Use of the block tread tire on snow-covered surfaces in Europe has produced no instability. The Mu-Meter tow vehicle was also not equipped with snow tires and thus was unable to maintain traction and towing speed on some runs over the snow-covered surface.

4.4 Average Runway Test Section Water Depth - Water depth measurements were made beside each runway marker by the water depth measuring test crew in the aircraft left, nose, and right main wheel tracks of the runway test section at three separate intervals during an aircraft test run sequence. These many individual water depth measurements were used to determine the average test section water depth values listed in table VI. These water depth values were plotted against the time from aircraft run data (see figure 35) so that an interpolated value of average test section water depth at time of aircraft run could be obtained. It should be noted, however, that the water depth measurement times listed in table VI are given to the nearest minute whereas the time values used to determine average water depth at time of aircraft test run were plotted to the nearest tenth of a minute (see figure 35). In figure 35, this technique yielded an average test section water depth of 0.021 at the time aircraft run 47 was made. This procedure was followed for each aircraft wet test run and the results obtained are listed in tables V and IX.

4.5 Ground Vehicle Correlation Tests - Prior to commencing aircraft tests at NASA Wallops Station, a series of comparative tests were conducted using two DBV's and two Mu-Meters. The NASA DBV and the FAA DBV, the USAF Mu-Meter and FAA Mu-Meter were the vehicles tested. The series of tests were made on the test runway 04/22 and on runway 10/28 at Wallops under dry, wet, and ice-covered surface conditions. The data from these tests are presented in table XVI. A discussion of these data follow in section 5.

5.0 RESULTS AND DISCUSSION

5.1 General.- This section of the paper briefly describes some of the preliminary results observed during a limited analysis of the test data. As mentioned in paragraph 1.6, the purpose of this paper is to present the preliminary data obtained from the test program. These data will be further analyzed and combined with the data from tests on the B-727-100 airplane of the test program and the results published at a later date.

5.1.1 It was noticed during the data analysis that brake application upon wheel recovery after a brake release from the Mark II anti-skid system was often delayed for as much as 1/4 to 3/4 second on the right landing gear wheels as compared with the left landing gear wheels (particularly on the more slippery runway surfaces investigated. (See Lockheed run time histories 44, 45, 46, 47 and 48 and Edwards run time histories 66, 66A, 67, 70, 68A and 71 in the Appendix for examples of this behavior.) This abnormal behavior of the Mark II anti-skid system was also noted during Mark II braking runs at Edmonton on the snow-covered runway and at Wallops during Mark II braking runs on runway 4/22 (.08 inch water depth). The Mark IIIA anti-skid system, in contrast to the Mark II anti-skid system, appeared to function normally on all braking runs of the program regardless of the slipperiness of the runway surface.

5.1.2 A Hydro-Aire/Douglas Company simulation study of the DC-9 Mark II anti-skid system, which duplicated some of the test runs, suggested that this abnormal behavior could be explained if the right-hand pilot's metering valve was out of rig. A check of the test aircraft hydraulic system was made two months after the conclusion of the test program (see table XV) which confirmed the Hydro-Aire/Douglas analysis.

5.1.3 The combination of the reduced fluid flow through the pilot's metering valve and the Mark II control valve characteristics was such that a reduced inlet pressure (from 3000 psi system pressure) at the Mark II control valve effectively reduces fluid flow through the valve and increases the brake cavity refill time. For this reason, Mark II braking runs on slippery runways where the anti-skid system fully dumped wheel brake pressures, suffered prolonged brake refill times on the right landing gear wheels and thus delayed pressure buildup on the right landing gear brakes. This problem did not occur on Mark II braking runs on dry runways and on high friction wet runways (Wallops and Houston) because the anti-skid system only partially dumped pressure (fluid) from the brake cavities and excessive refill times did not occur.

5.1.4 Preliminary results from the Hydro-Aire/Douglas DC-9 Mark II anti-skid system simulation study suggest that the test aircraft "out of rig" condition of the right-hand pilot's metering valve during the test program may have increased the DC-9 stopping distances on slippery runways by as much as 4 percent over that obtained when the pilot's metering valve is within tolerance. This estimate should be confirmed by actual flight tests conducted with the pilot's metering valve rigged properly on the test aircraft.

5.2 NASA Wallops Station

5.2.1 Nine dry and three wet maximum braking aircraft stops were made at NASA Wallops Station on runway 10/28. The water depth variations with time for the braking runs performed on runway 10/28 are shown in figure 37(a). Time histories of the aircraft parameters recorded by the aircraft magnetic tape recorder as well as computed average braking friction coefficient and wheel slip ratio are shown in the Appendix. Time histories for runs 23, 24, and 25 were not obtained with the magnetic tape recorder. Data for these runs, however, were obtained with the Douglas photorheciolite as shown in table IX. Wet runway testing on runway 10/28 was abbreviated due to high winds that prevailed during most of the allocated test time for this purpose.

5.2.2 Five calibrations runs were made on runway 4/22 for the purpose of calibrating the nose wheel instrumentation and for obtaining data on aircraft aerodynamic drag. These runs (runs 1 through 5) will be more completely analyzed at a later date. Time histories for runs 1 through 5 are shown in the Appendix.

5.2.3 Four abbreviated maximum braking runs were made on runway 4/22 over a test section length of approximately 2050 feet under wet runway conditions. Brakes were applied at the entrance into the test section (first event marker) and released when exiting the test section (last event marker), as shown in the time histories for these runs (runs 106-109) in the Appendix. The test section on runway 4/22 contained the following types of pavement surfaces as delineated by the event markers in the time histories of the Appendix:

Event Marker	Length, ft	Test Section Description	Surface
1-2	350	Canvas-belt drag finished concrete, ungrooved	A
2-3	350	Canvas-belt drag finished concrete, grooved (1 in. x 1/4 in. x 1/4 in.)	B
3-4	350	Burlap-drag finished concrete, grooved (1 in. x 1/4 in. x 1/4 in.)	C
4-5	350	Burlap-drag finished concrete, ungrooved	D
5-6	650	Smooth sand asphalt (Gripstop), ungrooved	E

The maximum water depth for these runs averaged approximately .08 inch in the test section. A near or complete dynamic hydroplaning situation is indicated in surface A because the aircraft wheels did not recover synchronous speed when wheel brakes pressures were released by the anti-skid control system

after initial brake application. When the aircraft entered the grooved pavement (surfaces B and C) of the test section, synchronous wheel speeds were obtained on the main landing gear wheels and effective wheel braking commenced on the grooved pavement. This effective braking was lost upon entering the smooth concrete surface D and continued at low friction levels on the smooth sand asphalt surface E. These data tend to indicate that the worn tread DC-9 main landing gear tires will hydroplane at high speed on smooth pavement surfaces at water depths approaching .08 inch during wheel braking. It is interesting to note that the unbraked nose wheel tires (tread in new condition) did not exhibit this wheel spin-down tendency when exposed to the same aircraft speed and runway wetness conditions as the unbraked main landing gear wheels.

5.2.4 The variation of the DC-9 aircraft stopping distance with ground speed squared is shown in figure 21(a) for all wet and dry runs on runway 10/28 in which the aircraft magnetic tape recorder was operative. The correlation obtained between aircraft, DBV, and Mu-Meter for these runs are shown in figure 37(a).

5.3 Lubbock Regional Airport

5.3.1 Eight dry and nine wet maximum braking aircraft stops were made at Lubbock Regional Airport on runway 08L/26R. In addition four dry and four wet runs were made using normal reverse thrust on both engines and maximum braking in the wetted test section. The water depth variation with time for twelve wet runs (run 110 is omitted since it was a low speed taxi test) is shown in figure 37(b). Each run was faired separately to obtain the data shown in table IX. The average water depth varied from 0.013 inch to 0.034 inch at the time of aircraft test. No wheel lockups were experienced during these wet stops but the aircraft exited the wetted test section prior to a complete stop during runs 44 and 56 which were conducted at the heavy aircraft landing gross weights. For these two particular runs, incremental stopping distances from "BRAKE OFF" speed to a full stop were estimated from figures 21(b) and (c). These incremental stopping distances were added to the braking distances obtained in the wet test section from the NASA counter magnetic tape data to obtain the aircraft stopping distances shown in table IX for a full stop condition from brake application speed.

5.3.2 All of the data points (except aircraft run 110, a low speed taxi test) obtained at Lubbock for the aircraft, DBV, and Mu-Meter are shown in figure 37(b). Actual time histories of the pertinent aircraft parameters for each aircraft braking run at Lubbock are given in the Appendix to this paper. Also included in the Appendix is the variation of computed friction coefficient with both ground speed and slip ratio during each run.

5.4 Edwards Air Force Base

5.4.1 Eight dry and nine wet maximum braking aircraft runs were made at Edwards AFB on runway 04/22. In addition, three wet runs were made on this runway using normal reverse thrust on both engines along with maximum braking in the wetted test section. Time histories of the aircraft parameters recorded by the aircraft magnetic tape recorder as well as computed average

braking friction coefficients and wheel slip ratio for these runs are shown in the Appendix. Spoilers initially extended but then immediately retracted during runs 66 and 68. In the case of run 66, a maximum braking run with Mark II anti-skid, the loss of spoilers during the run reduced the wheel braking forces, and the aircraft exited the wet test section at a speed of approximately 46 knots. For run 68, a normal reverse thrust and maximum braking run, the loss of spoilers caused the aircraft to bounce during landing. After the first touchdown, the braked wheels locked, and the aircraft slid along the runway centerline weathercocking up to ±10 degrees yaw angle. Reverted rubber formed on the sliding main gear tires and the aircraft deceleration after the pilot disengaged reverse thrust was approximately .05 g, a wheel braking friction level indicative of reverted rubber hydroplaning. Except for run 68, the aircraft experienced no wheel lockups during the remaining maximum braking runs at Edwards AFB. These two runs were repeated (runs 66A and 68A) and normal aircraft performance was obtained for the repeat runs.

5.4.2 The water depth variation with time for the wet runs is shown in figure 37(c). Each run was faired separately to obtain the water depth data shown in table IX. The average water depth for the wet runs varied between 0.008 and 0.040 inch. For runs 77, 67, 68, and 69, one percent of organic foam was mixed with the tanker water supply to obtain a water depth on the runway greater than that developed from the use of water alone. All of the data points (except the no spoiler runs 66 and 68) obtained at Edwards for the aircraft, DBV, and Mu-Meter are shown in figure 37(c).

5.5 Edmonton International Airport

5.5.1 Nine maximum braking aircraft runs were made at Edmonton on runway 11/29 under a snow-covered runway condition. Because of weather restrictions, all aircraft runs were accelerate-stop type of tests. During the night following arrival at Edmonton, airport personnel using snow blowers made a snow-covered test section in the center of the runway approximately 6000 feet long, 60 feet wide, and 1-2 inches thick. The snow was obtained from snow banks located along the sides of the runway that had accumulated from previous snow falls. The snow in the test section was not characteristic of freshly fallen snow in that some of this old snow had recrystalized to form ice particles. A snow rake was used to level the snow in the test section and this technique was employed to relevel the test bed after each aircraft test run. Aircraft runs 114, 114A, 114B, and 114C were conducted with a snow depth of 1-2 inches. For the remaining aircraft runs at Edmonton, the average snow depth in the test section was reduced to 0.3-0.4 inch and natural snow was observed to be lightly falling during these test runs. During run 114B, the brakes were released prior to full stop of the aircraft and, therefore, aircraft data for this run are omitted from table IX.

5.5.2 Time histories of the aircraft parameters recorded by the aircraft magnetic tape recorder as well as computed average braking coefficients and main wheel slip ratios for each test run at Edmonton are shown in the Appendix. The variation of aircraft stopping distance with ground speed squared is shown in figures 21(g) and (h). All of the data points obtained at Edmonton for the aircraft, DBV, and Mu-Meter are shown in figure 37(d).

5.5.3 It should be noted that the aircraft main gear tires tended to break through the snow cover down to the bare concrete surface during maximum braking runs. The unbraked nose wheels of the aircraft on the other hand tended to lose traction (lose synchronous speed) in the deeper snow depths on the runway. These effects can be observed in the time histories of the aircraft runs shown in the Appendix. The snow cover at Houston was nominally slippery to both the Mu-Meter and the DBV even at the deepest snow depths of 3/4 - 1 inch. The NASA DBV had difficulty attaining 60 mph test speed in the snow-covered test section. Test speeds were readily achieved by accelerating to test speed on the dry runway beside the snow-covered test section, turning into the test bed at slightly above test speed, and then conducting the braking test. No loss of control was experienced by the NASA DBV using this technique; however, in one instance, the Mu-Meter [illegible] accelerating to test speed in the snow-covered test section and began cut. The Mu-Meter had difficulty maintaining a steady course in the snow-covered test section at speeds above 20-30 mph, especially in the deeper snow depths. At the higher test speeds, the Mu-Meter trailer tended to develop a yaw oscillation which affected the friction readings. It was stated by Mu-Meter personnel that this oscillation would have been reduced or eliminated if the test Mu-Meter center wheel had been equipped with a block-tread tire.

5.6 Houston Intercontinental Airport

5.6.1 Five dry and four wet maximum braking aircraft runs were made at Houston on runway 26R. Grooving of this runway to a 2 in. x 1/4 in. x 1/4 in. transverse pattern was completed a week before aircraft arrival for test. The runway grooving increased water drainage from the runway such that after the water tankers passed a water depth measuring station, there was no measurable depth of water left on the runway. Water deposited in the test section of the runway varied from 4000 gallons for run 102 to 7500 gallons for runs 103 and 105. The increased runway wetness for those runs having larger quantities of tanker water dispersed, while not measureable with water depth gages, did increase runway slipperiness as indicated by the data shown for the aircraft, DBV, and Mu-Meter in figure 37(e).

5.6.2 Time histories of the aircraft parameters recorded by the magnetic tape recorder as well as calculated average friction coefficients and main wheel slip ratios for each aircraft test run are shown in the Appendix. The variation of aircraft stopping distance with ground speed squared for each test run is shown in figures 37(f) and 38.

5.7 Preliminary Results - Aircraft

5.7.1 Analysis of the aircraft run time histories and associated computed friction coefficients and main wheel slip ratios (Appendix) developed by the Mark II and Mark IIIA anti-skid systems indicate that both systems tended to control the braking wheels at relatively low slip ratios during full stop braking tests. Only occasional deep wheel skids were developed on the braking wheels and these occurred usually at brake application in the deeper water depth runs at Lubbock and Edwards. Prolonged main wheel lockups occurred only during run 68 at Edwards which must be treated as a unique case because of the bounce at touchdown and loss of spoilers during the run.

As can be seen in table V, several runs at Edwards and Lubbock were made in the presence of strong crosswinds. For these particular runs, the pilot reported good aircraft directional control during maximum braking on the wet runways. This retention of aircraft directional control under maximum braking conditions on slippery runways in crosswind conditions is consistent with NASA research results (ref. 4) when the braking wheels are [illegible] research also shows that tire cornering capability [illegible] control is seriously degraded when pilot or [illegible] systems control wheel braking at high slip ratio [illegible].

5.7.2 It should be pointed out that anti-skid systems can only release wheel brake pressures in controlling braking wheel rotation at [illegible] depths on the runway. [illegible] unbraked wheel rotation or decrease or prevent wheel spin-up after brake release of a braked wheel. In this flooded runway situation, the anti-skid system would be unable to prevent partial or complete wheel lockups from occurring (anti-skid system has completely removed pressure from braking wheels). The time histories of runs 105, 107, 108, and 109 (see Appendix) suggest that such a critical water depth (0.08 in.) was reached on the smooth concrete (surface A) of the runway 4/22 test section at Wallops.

5.7.3 Analysis of the computed average friction coefficients developed by the DC-9 Mark II and IIIA anti-skid systems during maximum braking runs on wet runways (see Appendix) indicate that these systems generally produced lower friction levels under high-speed slippery runway conditions than was found for the B-727 Mark II anti-skid system maximum braking runs performed under similar speed and slippery runway conditions (excluding B-727 prolonged wheel lockup runs). The fact that the B-727 Mark II system tended to operate at higher wheel slip ratio levels than the DC-9 Mark II or Mark IIIA systems for these test conditions suggests the possibility that the DC-9 Mark II and IIIA wheel slip ratio level was not sufficiently high enough to develop all of the available tire-ground braking friction potential existing under these high-speed slippery runway conditions. These trends may explain the relatively high wet/dry stopping distance ratios developed by the DC-9 aircraft on the more slippery Lubbock and Edwards wet runways. These trends also point out a possible dilemma facing aircraft anti-skid braking system designers; that is, how to develop maximum braking friction for minimizing aircraft stopping distances on slippery runways and yet maintain maximum or adequate tire cornering capability for retention of aircraft directional control on slippery runways under crosswind or asymmetrical reverse thrust conditions.

5.7.4 The Mark IIIA anti-skid system tends to develop more of the available tire-ground friction coefficient under dry runway conditions than the Mark II system. The result is higher average braking friction coefficients for Mark IIIA braking runs especially near brake application speeds and shorter aircraft stopping distances than for Mark II braking runs as shown in figure 22. The trends of the average friction coefficient data, which reflect the trends of the basic tire-ground friction data as modified by anti-skid system operating characteristics, indicate that the aircraft tire friction coefficient tends to be independent of ground speed on the dry and snow-covered runway surfaces investigated, but is dependent upon ground speed for the wet runway surfaces investigated. On the wet runway surfaces investigated,

the average friction coefficient tends to decrease with increasing ground speed. The amount of decrease appears to be a function of water depth and runway surface texture. These trends are in agreement with [illegible] viscous and dynamic hydroplaning [illegible] (see ref. 11).

5.7.5 The [illegible] to a stop for most [illegible] distance is plotted against [illegible] figure indicate that [illegible] manner on dry runways, especially after [illegible] stabilized condition on the runway. For [illegible] indicate a trend for [illegible] water depth on the runway. The use of thrust reversal is shown to be quite effective in improving aircraft maximum anti-skid braking is shown to be quite effective in improving aircraft stopping performance on a wet runway by comparing figure 31(d) (normal reverse thrust with maximum anti-skid braking) with figures 31(b) and 31(c) (maximum anti-skid braking only).

5.7.6 The variation of aircraft stopping distance ratio with ground speed for stabilized braking conditions is shown in figure 26 for the runways investigated. The vertical lines in this figure indicate the approximate brake application speed range experienced by the test aircraft over its landing gross weight range. The data in this figure indicate a trend for the aircraft SDR to remain at fairly constant levels over this brake application speed range for most test runs.

5.8 Preliminary Results - DBV/DBV Correlation.- A limited correlation study between two DBV vehicles was conducted at Wallops several days prior to the arrival of the DC-9 test aircraft. The time correlated data obtained from this study are shown in table XVI. It should be noted that the NASA DBV was a 1969 sedan-type automobile while the FAA DBV was a 1968 station wagon type automobile.

5.8.1 Figure 30(a) [illegible] by the test vehicles over a brake application [illegible] 20 to 60 mph on dry runway [illegible] stopping distance from brake application [illegible] FAA and NASA DBV stopping [illegible]

5.8.2 The slippery stopping surface [illegible] runway covered with [illegible] ure 30(b) shows the comparison of NASA and FAA DBV stopping distance obtained for this ice surface condition over a brake application speed range from approximately 20-40 mph. It should be noted that for this low runway friction condition, the DBV stopping distance ratio tends to decrease with increasing brake application speed. This trend suggests that aerodynamic drag effects can affect DBV stopping performance at low runway friction levels. This contrasts with the results shown in figure 30(a) which indicates that aerodynamic drag has little effect on DBV stopping performance on dry runways over the brake application speed range (20-60 mph) investigated.

5.8.3 Figure 38 shows the stopping distance correlation obtained between the NASA DBV (sedan) and FAA DBV (station wagon) over a wide range of runway slipperiness conditions and test speeds. These time-correlated data were obtained from table XVI. Adjacent pairs of FAA and NASA DBV runs were compared where possible to minimize both the time between vehicle test runs and the possibility of the runway surface condition changing between test runs of the two vehicles. It should be pointed out that the ice/slush coating on the slurry-seal runway surface did not mask the surface asperities completely and was not as slippery a runway surface as was the glare ice coating on the smooth concrete runway surface. It is evident from figure 38 that a direct correlation exists between the NASA and FAA DBV stopping distance measurements within a scatter band of approximately ten percent for the runway surface and vehicle speed conditions investigated.

5.9 Preliminary Results - Mu-Meter/Mu-Meter Correlation.- A limited correlation study between two Mu-Meter trailers was conducted at Wallops several days prior to the arrival of the DC-9 test aircraft. The time-correlated data obtained from this study are shown in table XVI. It should be noted that the FAA Mu-Meter used in this correlation study was towed by a station wagon, while the USAF Mu-Meter studied was towed by the pickup truck (see figure 1(c)).

5.9.1 Figure 39 shows the comparison of friction readings obtained by the FAA and USAF Mu-Meters over a wide range of runway slipperiness conditions at a test speed of 40 mph. The data shown in figure 39 were obtained by plotting adjacent FAA and USAF Mu-Meter friction readings presented in table XVI. This technique was employed to minimize the time period between FAA and USAF Mu-Meter test measurements used in the comparisons, and thus minimize the effects of runway surface condition changes that occurred during the test period. The data shown in figure 39 indicate a direct correlation exists between FAA and USAF Mu-Meter friction measurements for the range of runway surface conditions shown. The scatter of the data in figure 39 is small under dry runway conditions (high friction) but the data scatter tends to increase as runway slipperiness increases and approaches ±10 percent for the glare ice runway surface condition (low friction). An exception to this type of correlation between [illegible] flooded smooth concrete runway data (data not plotted in figure 39) shown in table XVI. For this runway surface condition, large variations between USAF and FAA Mu-Meter friction readings are shown, and are attributed to water depth variations in the flooded runway test section.

5.9.2 The variation of friction reading with test speed for two different ice-covered runway surfaces is shown in figure 39 for the USAF and FAA Mu-Meters. The data shown in this figure indicate that the Mu-Meter friction reading tends to be independent of test speed over the 20-40 mph test speed range investigated for ice-covered runway surface conditions.

5.10 Preliminary Results - DBV/Mu-Meter Correlation.- The comparison of NASA DBV stopping distances from 60 mph brake application speed with Mu-Meter friction readings measured at 40 mph towing speed for the dry, wet, flooded, snow, and ice-covered runway conditions investigated is shown in figure 40. These data were obtained from tables VII, IX, and XVI.

5.10.1 The equation given in paragraph 4.2.5 states that vehicle stopping distance is proportional to the brake application speed squared and inversely proportional to the friction coefficient. The correlation curve of DBV stopping distance with DBV average friction coefficient, computed from this equation at a brake application speed of 60 mph is the shape of a rectangular hyperbola as one would expect for a reciprocal function. The correlation curve between DBV stopping distance (60 mph) and Mu-Meter friction reading (40 mph) would be expected to follow a similar trend if the Mu-Meter friction reading rating of runway slipperiness is the same as developed by the sliding (locked wheel) pair of tires of the DBV, for the many conditions investigated.

5.10.2 A hyperbolic-type-curve was faired through the data of figure 40 ignoring the Edmonton data obtained on a snow-covered runway. These data were ignored because the Mu-Meter trailer did not track the towing vehicle properly (oscillated in yaw) on this surface (see paragraph 5.5.3). The data scatter about this faired curve is rather large indicating considerable differences exist between Mu-Meter and DBV assessments of runway slipperiness for the range of runway surface conditions investigated.

5.11 Preliminary Results - DBV/Aircraft Correlation.- The comparison of time-correlated aircraft and DBV stopping distance ratio data obtained for the wet and dry runway conditions investigated is shown in figure 41. The aircraft SDR data shown in this figure were calculated from the aircraft data given in table IX by means of the WV^2, V^2, and S_{ew}/V_{ew}^2 methods described in paragraph 4.1.8. The S_{ew}/V_{ew}^2 method for calculating aircraft SDR, which corrects the aircraft test data to standard day, zero wind, sea level conditions, produces the least data scatter of the three methods used to compare aircraft SDR with DBV SDR as would be expected.

5.11.1 Boundary lines have been faired through the extremes of the data obtained from aircraft runs employing maximum anti-skid braking and no reverse thrust in figure 41. The trends shown indicate a nonlinear line of correlation between test aircraft and DBV SDR data for the range of wet runway conditions investigated, with the DBV showing a less slippery runway condition than that experienced by the test aircraft, especially on the Lubbock and Edwards runways.

5.11.2 The old snow with crystallized ice particles used to cover the Edmonton runway (see paragraph 5.5.1) may not be representative of runways covered with loose snow resulting from natural snow fall conditions. For this reason, the aircraft/DBV SDR data obtained during the Edmonton tests are not included in figure 41 for correlation purposes. These data are presented in figure 37(d) and indicate that the Edmonton snow-covered runway produced a more slippery surface for the DBV than for the test aircraft.

5.11.3 Figure 29 shows the comparison of aircraft and DBV average friction coefficients obtained for the dry and wet runway conditions investigated. The aircraft μ_{avg} values were calculated by the method described in paragraph 4.1.12. The DBV μ_{avg} values are calculated by the method described in paragraph 4.2.5. This method of comparing aircraft and DBV data shows a more linear correlation between aircraft and DBV μ_{avg} values than obtained by comparing aircraft and DBV SDR values (figure 41) for the

range of dry and wet runway conditions investigated. The scatter of the test data is also somewhat less for the μ_{avg} method than for the SDR method.

5.12 Preliminary Results - Mu-Meter/Aircraft Correlation.- Figure 41 shows the variation of aircraft SDR with Mu-Meter friction reading for the wet runway conditions investigated. It can be seen from this figure that while the aircraft SDR data computed by the different methods discussed in paragraph 4.1.8 differ somewhat in magnitude, the trends of the data are quite similar in nature. Boundary lines were faired through the extremes of the data points obtained from maximum braking runs in figure 42. These boundary lines indicate that the least data scatter in the comparison of aircraft SDR with Mu-Meter friction reading occurred using the WV^2 method for calculating aircraft SDR. The most data scatter in figure 42 is shown for the S_{ew}/V_{ew}^2 method for comparing aircraft SDR. It should be noted that this method corrects the aircraft stopping distance data to standard day, sea level, zero wind conditions for a standard aircraft gross weight of 80,000 pounds.

5.12.1 The British prefer to show the correlation of aircraft stopping distance with Mu-Meter friction reading under normalized aircraft stopping energy conditions. This method is illustrated in figure 43 where Mu-Meter friction reading is compared with test aircraft stopping distance normalized to a constant energy level ($WV^2 = 10 \times 10^8$). Boundary lines have been faired through the data obtained under aircraft maximum braking (no reverse thrust) conditions. At a Mu-Meter friction reading of 0.5, the data scatter about a mean point between the boundary lines is approximately ±15 percent.

5.12.2 Figure 44 compares the average friction coefficient obtained by the aircraft during a braking stop with Mu-Meter friction reading. These data were obtained from table IX. The aircraft μ_{avg} was calculated by the method described in paragraph 4.1.12. This method of comparing aircraft stopping performance with Mu-Meter friction reading indicates a non-linear correlation between two quantities for the range of dry and wet runway conditions investigated.

5.12.3 The Mu-Meter friction readings obtained on the snow-covered Edmonton runway are of questionable validity due to trailer instability problems on this surface (see paragraph 5.5.3). The Mu-Meter friction readings are very low for this surface and indicate a more slippery runway condition than the aircraft experienced (see table IX).

5.13 Preliminary Results - Houston Grooved Runway.- Runway 8L/26R at Houston was grooved to a 2 in. by 1/4 in. by 1/4 in. transverse pattern during the time period intervening between B-727 and DC-9 aircraft tests of the joint FAA-USAF-NASA Runway Research Program. This circumstance permitted a comparison to be made of aircraft, DBV, and Mu-Meter data obtained before and after runway grooving to estimate the effectiveness of this particular groove pattern in reducing wet runway slipperiness. Table XVII shows this comparison. In addition to the joint program data mentioned, table XVII also contains DBV data obtained on this runway during an NTSB study performed during 1970. At the time of the 1970 DBV tests, the Houston runway was heavily coated with rubber deposits in the touchdown areas. Shortly after the 1970 DBV tests, the runway was chemically treated to remove the rubber deposits. These deposits had built up again to some extent at the time of

Table I.- DC-9 aircraft test instrumentation.

Variable	Instrument	Recorder	
		Oscillograph 1/2 in./sec	Tape 7 -1/2 in./sec
Ground Speed (also displayed to pilot)	Nose Wheel Velocity (160 pulses/rev)	X	X
Stopping Distance (also displayed by rev. counter in cockpit)	Nose Wheel Revolution Pulses (2/rev)		X
Main Gear Wheel Speed (each wheel)	Main Gear Wheel Antiskid Detectors	X	X
Engine rpm (No. 1 and No. 2 engines)	Tachometers	X	X
Brake Pedal Position (left and right)	Linear Potentiometers	X	X
Brake Pressure (each main gear wheel and metering)	Pressure Transducers	X	X
Antiskid Valve Position (each main gear wheel)	Voltage Applied to Valve Solenoid	X	X
Longitudinal, Lateral, and Vertical Accelerations at c.g.	Accelerometers	X	X
Aircraft Heading	Yaw Attitude Gyro	X (± 360°)	X (± 15°)
Aircraft Pitch Attitude	Pitch (free gyro)	X	X
	Pitch (vertical gyro)	X	X
Spoiler Position	Linear Potentiometer	X	X
Event Marker		X	X
Time Correlation		X	X

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Table II.- Oscillograph system accuracy list.

Measurement	Nominal Range	Frequency Response	Accuracy	Remarks
3-Axis Acceleration C.G. (3)	± 1 G	6 cps	± .01 G	
Pitch Angle Relative (1)	± 20°	5 cps	±0.4°	Accuracy is for 30-second data period with gyro drifts
Yaw Angle Relative (1)	± 178°	5 cps	±2.3°	Accuracy is for 30-second data period with gyro drifts
Pitch Angle Vertical (1)	± 15°	5 cps	±2.0°	Accuracy is for 30-second data period with gyro drifts
Engine RPM #1 & #2 (2)	40 - 110%	5 cps	±1.4%	
Brake Pedal Position (2)	Full Scale	5 cps	±1.4%	Percent full scale
Spoiler Position (1)	Full Scale	5 cps	±1.4%	Percent full scale
Brake Pressure (10)	0 - 3000 psi	60 cps	±40 psi	Frequency response excludes pressure tubing
Ground Speed (1)	20 - 150 Kts	5 cps	±1.5 Kts	
Anti-Skid Valve Voltage (4)	0 - 10 Volts	60 cps	±0.1 Volt	Accuracy excluding anti-skid box and sensor
Main Wheel Velocities (4)	20 - 0 Volts	60 cps	±0.2 Volts	Accuracy excluding anti-skid box and sensor
Events (1)	Full Scale	600 cps	———	Excluding operator
Time	999 second	———	±1 part in 3000	Has 0.1 sec. pulses

Table III.- Magnetic tape recording system accuracy list.

Measurement	Nominal Range	Frequency Response	Accuracy	Remarks
3-Axis Accelerometer C.G. (3)	± 1 G	40 cps	±.014 G	
Anti-skid Valve Voltage	0-10 Volts	60 cps	±0.15 Volts	Accuracy excludes DC-9 anti-skid control box and sensor
Pitch Angle Relative (1)	± 15°	5 cps	±0.4°	Accuracy is for 30-second data period with gyro drifts
Yaw Angle Relative (1)	± 15°	5 cps	±0.4°	Accuracy is for 30-second data period with gyro drifts
Pitch Angle Vertical	± 15°	5 cps	±2.0°	Accuracy is for 30-second data period with gyro drifts
Engine RPM #1 & #2 (2)	0 - 110%	5 cps	±1.6%	
Brake Pedal Position (2)	Full Scale	5 cps	±1.5%	Percent full scale
Spoiler Position (1)	Full Scale	5 cps	±1.5%	Percent full scale
Brake Pressure (10)	0 - 3000 psi	100 cps	±48 psi	Frequency response excludes pressure tubing
Main Wheel Velocity (4)	0 - 90 Volts	100 cps	±0.3 Volts	Accuracy excludes anti-skid Control box and sensor
Nose Wheel Revolution Pulses (stopping distance)	2 pulses/rev	———	±1 pulse	
Ground Speed (1)	20 - 150 kts	5 cps	±2.2 kts	
Events (1)	Full Scale	100 cps		Excluding operator
Timer	999 second	———	±1 part in 10^6	Has 0.001 sec. pulses

Table IV.- NASA diagonal-braked vehicle (DBV) instrumentation.

NO	VARIABLE	INSTRUMENT	VISUAL DISPLAY	RECORDER (6-CHANNEL)
1	Ground speed	DC generator (5th wheel)		X
2	Brake application speed	Magnetic actuated reed switch coupled with crystal controlled timer (5th wheel) and hold circuit	Digital (1 mph units)	
3	Stopping distance (from brake application)		Digital (1 foot units)	
4	Brake application speed	DC generator (5th wheel) and hold circuit	Digital (0.1 mph units)	
5	Stopping distance (from brake application)	Magnetic pick-up (5th wheel) & hold circuit	Digital (1 foot units)	
6	Stopping distance (from brake application)	Revolution counter (5th wheel) & hold circuit	Digital (1 count/rev.)	
7	Main wheel speed (each wheel)	DC generators		X
8	Longitudinal acceleration (approx. c.g.)	Accelerometer		X
9	Brake application	Brake pedal micro-switch	X	X (Event channel)
10	Timer	Crystal oscillator		X

Table V.- Basic aircraft, atmospheric, and ground data for full stop aircraft runs.

(a) NASA Wallops Station Date: 2/12-15/72

AIRCRAFT RUN NO.	TIME OF TEST HR-MIN	AIRCRAFT CONDITIONS										ATMOSPHERIC CONDITIONS									
		GROUND SPEED, KNOTS (NOSE WHEEL)		STOPPING DISTANCE, FT		FUEL LOAD, LB	C.G. % MAC	GROSS WEIGHT, LB	ANTI-SKID BRAKE SYSTEM	FLAP ANGLE, DEG.	TEST R/W	AMBIENT AIR TEMPERATURE, °F		RELATIVE HUMIDITY, %	WIND		BAROMETRIC PRESSURE, IN./HG	WETNESS OR WATER DEPTH, IN.	ARTIFICIAL WETTING		TEST SURFACE TEMP., °F	SURFACE TEMP., °F
		BRAKE ON	BRAKE OFF	GROUND VISUAL	NOSE WHEEL TOUCH							DRY BULB	WET BULB		VEL., KNOTS	HEAD., DEG.			WATER DEPTH, IN.	GRADIENT, FT/100 FT		
5	0[illegible]	113	0	[illegible]					MK II	50	13	42	38	75	4	310						
[illegible]	[illegible]	109	0	[illegible]					MK II	[illegible]	13	42	38	75	5	310						
[illegible]	[illegible]	122	0	[illegible]					MK II	50	13	42	38	75	2	110						
8	1[illegible]	122	0	[illegible]					MK II	50	13	44	39	65	2	115						
9	1053	113	0	1330					MK II	50	13	46	41	65	4	100						
31	1[illegible]	107	0	1[illegible]					MK IIIA	[illegible]	10	48	43	62	5	155						
[illegible]	1[illegible]	120	0	1[illegible]					MK IIIA	50	10	47	42	68	5	125						
45	1[illegible]	120	0	1284					MK IIIA	50	10	45	41	70	6	155						
26	1[illegible]	112	0	1[illegible]					MK IIIA	50	10	48	43	62	3	150						
29	1[illegible]	121	0	[illegible]					MK II	50	10	41	39	85	5	055						
35	2[illegible]	118	0	[illegible]					MK II	50	10	40	38	87	5	070						
51	2[illegible]	113	0	[illegible]					MK II	50	10	39	38	90	5	070						

Table V.- Continued.

(b) Lubbock Regional Airport. Date: 2/16-18/72

AIRCRAFT RUN NO.	TIME OF TEST EST	AIRCRAFT CONDITIONS										ATMOSPHERIC CONDITIONS						RUNWAY CONDITION				
		GROUND SPEED, KNOTS (NOSE WHEEL)		STOPPING DISTANCE, FT		FUEL LOAD, LB	C.G. % MAC	GROSS WEIGHT, LB	ANTI-SKID BRAKE SYSTEM	FLAP ANGLE, DEG.	THRT R/V	AMBIENT AIR TEMPERATURE, °F		RELATIVE HUMIDITY, %	WIND		BARO-METRIC PRESSURE, IN./Hg	WETNESS OR WATER DEPTH, IN.	ARTIFICIAL WETTING		TEST SURFACE LENGTH, FT	SURFACE TEMP., °F
		BRAKE ON	BRAKE OFF	GROUND VISUAL	NOSE WHEEL CTR.							DRY BULB	WET BULB		VEL., KNOTS	HEAD., DEG.			TIME TO WET, MIN	GALLONS OF WATER USED		
40	1149	117	0	1534	-	16000	22.0	75930	Mk II	50	26	50	43	60	8	310	26.46	Dry	-	-	[illegible]	-
52	1206	125	0	1266	-	13400	22.5	74180	MkIIIA	50	26	50	43	60	10	320	26.46	Dry	-	-	[illegible]	-
50	1454	117	0	1525	-	22850	21.4	83710	MkIIIA	50	26	65	48	28	3	340	26.38	Dry	-	-	[illegible]	-
38	1509	136	0	1703	-	21500	21.0	82110	Mk II	50	26	71	49	18	4	300	26.38	Dry	-	-	[illegible]	-
39	1525	117	0	1518	-	20050	20.7	80660	Mk II	50	26	69	50	20	3	350	26.38	Dry	-	-	4000	-
51	1538	120	0	1474	-	18500	20.4	79110	MkIIIA	50	26	73	52	18	8	315	26.38	Dry	-	-	[illegible]	-
53	1553	126	0	1529	-	16850	20.8	77460	MkIIIA	50	26	69	49	18	2	320	26.38	Dry	-	-	[illegible]	-
41	1608	120	0	1418	-	15100	21.2	75710	Mk II	50	26	71	51	20	2	260	26.38	Dry	-	-	4000	-
42	1621	112	0	1154	-	13450	21.6	74060	Mk II	50	26	72	51	20	4	320	26.37	Dry	-	-	[illegible]	-
54	1636	113	0	1222	-	11900	21.7	72510	MkIIIA	50	26	69	49	18	2	330	26.37	Dry		-	[illegible]	-
55	1653	115	0	1026	-	10000	22.1	70610	MkIIIA	50	26	69	49	18	2	315	26.37	Dry		-	[illegible]	-
43	1707	112	0	1044	-	8800	22.0	69410	Mk II	50	26	67	48	20	1	280	26.37	Dry	-	-	[illegible]	-
44	1709	136	47	3984+	-	25250	21.7	82700	Mk II	50	26	64	51	40	4	340	26.57	0.013	9	7500	[illegible]	74
56	1738	116	66	3984+	-	23750	21.4	81200	MkIIIA	50	26	62	48	38	6	340	26.58	0.021	10	7500	[illegible]	72
58	1808	121	0	3761	-	17700	22.3	78150	MkIIIA	50	26	55	43	32	1	350	26.60	0.0179	9	7500	[illegible]	66
46	1839	132	0	4775	-	15150	23.0	75600	Mk II	50	26	47	41	60	Trace	360	26.60	0.021	9	7500	4500	62

Table V.- Continued.

(b) Lubbock Regional Airport. Date: 2/16-18/72

AIRCRAFT RUN NO.	TIME OF TEST HR-MIN	AIRCRAFT CONDITIONS										ATMOSPHERIC CONDITIONS						RUNWAY CONDITIONS				
		GROUND SPEED, KNOTS (NOSE WHEEL)		STOPPING DISTANCE, FT		FUEL LOAD, LB	C.G. % MAC	GROSS WEIGHT, LB	ANTI-SKID BRAKE SYSTEM	FLAP ANGLE, DEG.	TEST R/W	AMBIENT AIR TEMPERATURE, °F		RELATIVE HUMIDITY, %	WIND		BAROMETRIC PRESSURE, IN./Hg	WETNESS OF PATCH [illegible], %	ARTIFICIAL WETTING		TEST SURFACE LENGTH, FT	SURFACE TEMP., °F
		BRAKE ON	BRAKE OFF	GROUND VISUAL	NOSE WHEEL CTR.							DRY BULB	WET BULB		VEL., KNOTS	HEAD., DEG.			TIME TO RUN, MIN	[illegible] % PATCH		
110	0740	60	0	84[illegible]	-	[illegible]	[illegible]	63210	Mk II	50	08	30	29	95	4	070	[illegible]					
45	0800	107	0	2761	-	[illegible]	[illegible]	75360	Mk II	50	08	35	32	70	5	090	[illegible]					
47	0838	115	0	2417	-	[illegible]	[illegible]	73410	MkIIIA	50	08	41	34	50	3	095	[illegible]					
49	0906	108	0	2709	-	[illegible]	[illegible]	75080	MkIIIA	50	08	44	36	40	10	125	[illegible]					
47	0934	111	0	3427	-	[illegible]	[illegible]	73140	Mk II	50	08	47	38	40	9	130	[illegible]					
43	1004	104	0	3693	-	[illegible]	[illegible]	71540	Mk II	50	08	52	41	40	13	130	[illegible]					
60	1029	109	0	3100	-	[illegible]	[illegible]	59790	MkIIIA	50	08	53	43	40	11	140	[illegible]					
61	1054	109	0	1848	-	[illegible]	[illegible]	66240	MkIIIA	50	08	55	43	35	13	115	[illegible]					
49	1122	110	0	1785	-	[illegible]	[illegible]	66440	Mk II	50	08	55	44	38	6	140	[illegible]					

Table V.- Continued.

(c) Edwards Air Force Base.

Date: 2/19-20/72

AIRCRAFT RUN NO.	TIME OF TEST HR-MIN	AIRCRAFT CONDITIONS										ATMOSPHERIC CONDITIONS						RUNWAY CONDITION				
		GROUND SPEED, KNOTS (NOSE WHEEL)		STOPPING DISTANCE, FT		FUEL LOAD, LB	C.G. % MAC	GROSS WEIGHT, LB	ANTI-SKID BRAKE SYSTEM	FLAP ANGLE, DEG.	TEST R/W	AMBIENT AIR TEMPERATURE, °F		RELATIVE HUMIDITY, %	WIND		BAROMETRIC PRESSURE, IN./Hg	WETNESS OR WATER DEPTH, IN.	ARTIFICIAL WETTING		TEST SURFACE LENGTH, FT	SURFACE TEMP., °F
		BRAKE ON	BRAKE OFF	GROUND VISUAL	NOSE WHEEL CTR.							DRY BULB	WET BULB		VEL., KNOTS	HEAD., DEG.			TIME TO WET, MIN	GALLONS OF WATER USED		
62	0805	128	0	1556	1648	20950	22.9	81790	Mk II	50	04	54	44	45	Trace	015	27.71	Dry	-	-	6000	66
72	0820	117	0	1314	1386	19500	22.5	80340	MkIIIA	50	04	54	45	46	Trace	030	27.71	Dry	-	-	6000	66
73	0840	123	0	1340	1427	16850	22.9	77710	MkIIIA	50	04	57	45	35	0	-	27.72	Dry	-	-	6000	68
63	0854	124	0	1699	1798	15050	23.0	75910	Mk II	50	04	57	46	42	0	-	27.72	Dry	-	-	6000	71
64	0916	130	0	1654	1773	12300	23.4	73160	Mk II	50	04	62	48	40	0	-	27.71	Dry	-	-	6000	74
74	0933	123	0	1241	1357	9750	23.5	70610	MkIIIA	50	04	62	47	30	0	-	27.73	Dry	-	-	6000	80
75	0948	116	0	1125	1210	8150	23.5	69010	MkIIIA	50	04	68	51	25	0	-	27.73	Dry	-	-	6000	82
55	1009	120	0	1320	1430	5000	23.6	65860	Mk II	50	04	68	49	20	2	220	27.74	Dry	-	-	6000	82
66	0648	128	45.8	6076+	6198	19850	22.2	81680	Mk II	50	22	39	36	68	4	200	27.76	0.017	10	10000	6000	43
66A	0720	119	0	3260	3389	18000	22.2	79830	Mk II	50	22	41	37	70	5	205	27.76	0.0125	9	10000	6000	44
76	0752	125	0	3650	3722	15900	22.2	77830	MkIIIA	50	22	44	40	70	3	175	27.76	0.015	9	10000	6000	54
77	0835	123	0	3660	3811	13950	22.7	75480	MkIIIA	50	22	52	45	60	6	190	27.77	0.024	10	10000	6000	59
67	0912	119	0	3716	3872	11150	22.9	73080	Mk II	50	22	60	50	48	7	200	27.77	0.036	7	10000	6000	63
68	0959	117	0	-	-	8225	22.9	70455	Mk II	50	22	64	56	60	9	220	27.77	0.040	9	10000	6000	78
70	1044	110	0	3457	3542	5950	22.9	67880	Mk II	50	22	70	57	42	6	210	27.76	0.033	8	10000	6000	81
80	1119	103	0	2600	2752	4150	23.0	66080	MkIIIA	50	22	74	59	40	6	240	27.76	0.031	7	10000	6000	82

Table V .- Continued.

(c) Edwards Air Force Base.

Date: 2/19-20/72

AIRCRAFT RUN NO.	TIME OF TEST HR-MIN	AIRCRAFT CONDITIONS									ATMOSPHERIC CONDITIONS						RUNWAY CONDITION				
		GROUND SPEED, KNOTS (NOSE WHEEL)		STOPPING DISTANCE, FT		FUEL LOAD, LB	C.G. % MAC	GROSS WEIGHT, LB	ANTI-SKID BRAKE SYSTEM	FLAP ANGLE, DEG.	TEST H/W	AMBIENT AIR TEMPERATURE, °F		RELATIVE HUMIDITY, %	WIND		BAROMETRIC PRESSURE, IN./Hg	WETNESS OR WATER DEPTH, IN.	ARTIFICIAL WETTING		TEST SURFACE LENGTH, FT	SURFACE TEMP., °F
		BRAKE ON	BRAKE OFF	GROUND VISUAL	NOSE WHEEL STR.							DRY BULB	WET BULB		VEL., KNOTS	HEAD., DEG.			TIME TO WET, MIN	GALLONS OF WATER USED		
78	1232	110	0	1968	2038	13550	23.6	76050	Mk III A	50	22	77	60	35	8	235	27.72	0.[illegible]	[illegible]	[illegible]	[illegible]	64
68A	1340	108	0	1865	1939	12150	23.3	74400	Mk II	50	22	77	58	34	14	250	27.63	0.025	8	2[illegible]	[illegible]	73
71	1414	108	0	3258	3347	10350	23.1	71850	Mk II	50	22	77	60	35	15	235	27.67	[illegible]	8	[illegible]	[illegible]	62
81	1444	103	0	2752	2806	8800	23.9	70300	Mk III A	50	22	77	57	28	9	200	27.66	0.[illegible]	6	[illegible]	[illegible]	80

Table V.- Continued.

(d) Edmonton International Airport.

Date: 2/22/72

AIRCRAFT RUN NO.	TIME OF TEST HR-MIN	AIRCRAFT CONDITIONS										ATMOSPHERIC CONDITIONS						RUNWAY CONDITION				
		GROUND SPEED, KNOTS (NOSE WHEEL)		STOPPING DISTANCE, FT		FUEL LOAD, LB	C.G. % MAC	GROSS WEIGHT, LB	ANTI-SKID BRAKE SYSTEM	FLAP ANGLE, DEG.	TEST D/W	AMBIENT AIR TEMPERATURE, °F		RELATIVE HUMIDITY, %	WIND		BAROMETRIC PRESSURE, IN./Hg	WETNESS OR WATER DEPTH, IN.	ARTIFICIAL WETTING		TEST SURFACE LENGTH, FT	SURFACE TEMP., °F
		BRAKE ON	BRAKE OFF	GROUND VISUAL	NOSE WHEEL CTR.							DRY BULB	WET BULB		VEL., KNOTS	HEAD., DEG.			TIME TO WET, MIN	GALLONS OF WATER USED		
114	0921	40	0	-	573	23000	23.7	83000	Mk II	50	11	+1	-	-	4	310	27.58	1 - 2	-	-	6000	-
114A	0924	55	0	-	611	23000	23.7	83000	Mk II	50	11	+1	-	-	4	310	27.58	1 - 2	-	-	6000	-
114B	0925	37	-	-	438	23000	23.7	83000	Mk II	50	11	+1	-	-	4	310	27.58	1 - 2	-	-	6000	-
114C	0956	76	0	1460	1424	22350	23.9	81750	Mk II	50	11	+1	-	-	4	310	27.58	1 - 2	-	-	6000	-
116	1523	62	0	1140	1299	19700	24.8	79100	Mk II	50	29	+1	-	-	3	315	27.58	0.3-0.4	-	-	6000	-
117	1551	81	0	1890	2003	18900	25.1	78300	Mk II	50	29	+1	-	-	3	310	27.59	0.3-0.4	-	-	6000	-
118	1671	92	0	2790	2835	18150	25.4	77550	Mk II	50	29	+1	-	-	3	310	27.59	0.3-0.4	-	-	6000	-
119	1643	110	0	2785	2893	16900	25.7	76300	Mk IIIA	50	29	+1	-	-	4	310	27.59	0.3-0.4	-	-	6000	-
120	1705	106	0	2935	2909	15650	25.5	75050	Mk IIIA	50	29	+1	-	-	3	310	27.60	0.3-0.4	-	-	6000	-

Table V.- Concluded.

(e) Houston Intercontinental Airport.

Date: 2/25/72

AIRCRAFT RUN NO.	TIME OF TEST HR-MIN	AIRCRAFT CONDITIONS									ATMOSPHERIC CONDITIONS						RUNWAY CONDITION				
		GROUND SPEED, KNOTS (NOSE WHEEL)		STOPPING DISTANCE, FT		FUEL LOAD, LB	C.G. % MAC	GROSS WEIGHT, LB	ANTI-SKID BRAKE SYSTEM	FLAP ANGLE, DEG.	TEST H/W	AMBIENT AIR TEMPERATURE, °F		RELATIVE HUMIDITY, %	WIND		BAROMETRIC PRESSURE, IN./Hg	WETNESS OF WATER (DEPTH), IN.	ARTIFICIAL WETTING		TEST SURFACE IDENTIFICATION, FT	SURFACE TEMP., °F
		BRAKE ON	BRAKE OFF	GROUND VISUAL	NOSE WHEEL CTR.							DRY BULB	WET BULB		VEL., KNOTS	HEAD., DEG.			TIME TO WET, MIN	RATE OF WATER USED		
98	0955	123	0	1581	1660	22400	23.6	81310	Mk II	50	26	69	68	95	5	180	29.77	.04	-	-	3000	-
100	1019	114	0	1315	1381	20400	23.5	79310	Mk IIIA	50	26	69	66	82	8	150	29.75	.04			3000	-
100A	1041	110	0	1020	1078	17400	24.2	76410	Mk IIIA	50	26	73	69	75	10	130	29.72	-	-	-	3000	-
101	1104	111	0	1110	1190	14,500	24.7	73160	Mk IIIA	50	26	76	69	72	13	200	29.74	.03	-	-	3000	-
99	1121	107.5	0	1216	1274	12000	25.2	70910	Mk II	50	26	74	67	70	10	180	29.74	Dry	-	-	3000	-
102	1320	118	0	1491	1577	23950	23.1	82530	Mk II	50	26	87	72	48	5	220	29.72	Damp	-	[illegible]	3000	-
104	1346	130	0	2210	2333	20000	23.5	80530	Mk IIIA	50	26	89	73	45	13	180	29.7	Wet	-	[illegible]	3000	-
105	1428	127	0	2087	2249	16500	24.3	75030	Mk IIIA	50	26	87	73	52	10	190	29.7	Wet	-	7[illegible]	3000	-
103	1506	123.5	0	2308	2519	13800	25.0	72130	Mk II	50	26	86	75	60	10	190	29.63	Wet	10	7	3000	-

Table VI.- Runway test section average water depth (and snow depth) for full stop aircraft tests (based on water (snow) depth measurements taken beside the left main, nose, and right main aircraft wheel tracks in runway test section).

AIRPORT	AIRCRAFT RUN NO.	AIRCRAFT TIME OF TEST (LOCAL)	WATER DEPTH MEASUREMENT TIME LOCAL	WATER DEPTH MEASUREMENT TIME RELATIVE TO A/C TEST, MIN	WATER DEPTH MEASUREMENT AVERAGE WATER DEPTH, IN.
WALLOPS	19	1648	1641	-7	0.023
			1650	+2	0.009
			1652	+4	0.004
	20	1714	1708	-6	0.034
			1716	+2	0.008
			1719	+5	0.007
	21	1742	1735	-7	0.026
			1743	+1	0.008
			1746	+4	0.006
LUBBOCK	44	1709	1704	-5	0.044
			1706	-3	0.013
			1712	+3	0.010
			1715	+6	0.011
	56	1738	1735	-3	0.052
			1736	-2	0.024
			1740	+2	0.015
			1742	+4	0.009
	58	1808	1805	-3	0.051
			1807	-1	0.019
			1811	+3	0.007
			1814	+6	0.007
	46	1839	1836	-3	0.047
			1840	+1	0.010
			1841	+2	0.006
	110	0740	0738	-2	0.034
			0739	-1	0.014
			0744	+4	0.004
	45	0806	0802	-4	0.034
			0804	-2	0.010
			0808	+2	0.006
	57	0838	0835	-3	0.049
			0839	+1	0.028
			0841	+3	0.014
LUBBOCK	59	0906	0903	-3	0.050
			0905	-1	0.022
			0910	+4	0.007
	47	0934	0929	-5	0.046
			0933	-1	0.022
			0936	+2	0.008
	48	1001	0958	-3	0.049
			1002	+1	0.025
			1004	+3	0.014
	60	1029	1025	-4	0.053
			1030	+1	0.019
			1032	+3	0.009
	61	1054	1050	-4	0.054
			1053	-1	0.020
			1057	+3	0.010
	49	1122	1118	-4	0.049
			1121	-1	0.026
			1124	+2	0.006
EDWARDS	66	0647	0643	-4	0.028
			0649	+2	0.011
			0651	+4	0.004
	66A	0720	0716	-4	0.030
			0721	+1	0.011
			0724	+4	0.007
	76	0752	0748	-4	0.033
			0753	+1	0.012
			0756	+4	0.008
	77	0835	0831	-4	0.051
			0836	+1	0.021
			0840	+5	0.016
	67	0912	0909	-3	0.046
			0913	+1	0.032
			0916	+4	0.024
EDWARDS	68	1000	0957	-3	0.046
			1003	+3	0.029
			1005	+5	0.018
	70	1044	1040	-4	0.056
			1046	+2	0.028
			1048	+4	0.024
	80	1119	1115	-4	0.044
			1117	-2	0.025
			1121	+2	0.019
	78	1232	1228	-4	0.042
			1231	+1	0.009
			1235	+3	0.003
	68A	1340	1336	-4	0.027
			1341	+1	0.004
			1344	+4	0.001
	71	1414	1412	-4	0.028
			1415	+1	0.016
			1417	+3	0.007
	81	1444	1442	-2	0.033
			1445	+2	0.015
			1448	+5	0.013
EDMONTON	114	0921	SNOW-COVERED RUNWAY		1-2
	114A	0928			
	118	0925			
	115	1523			0.3-0.4
	117	1550			
	113	1634			
	109	1642			
	110	1705			
HOUSTON	102	1320	GROOVED RUNWAY NO MEASURABLE WATER DEPTH SURFACE DAMP WITH SOME ISOLATED PUDDLES		
	104	1346			
	105	1426			
	103	1505			

Table VII.- Basic DBV and Mu-Meter dry surface data for full stop aircraft runs.

AIRPORT	DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TEST SECTION AREA COVERED	TEMPERATURE, °F		NASA DBV				MU-METER				
						AMBIENT AIR	RUNWAY SURFACE	STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READINGS			
								TRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT		INTEGRATED AVERAGE	RECORDED		
														AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
Wallops	2/12/72	MU-M	1	0910	A-G	42	——					40	0.79	0.77	0.80	0.78
"	"	DBV	1	0911	A	42	——	60.7	312	61	322					
"	"	DBV	1A	0912	D	42	——	59.9	307	60	310					
"	"	MU-M	2	1304	A-G	45	——					40	0.78	0.77	0.79	0.75
"	"	DBV	2	1304	A	45	——	59.9	308	62	320					
"	"	DBV	2A	1305	D	45	——	60.0	308	60	317					
Lubbock	2/17/72	MU-M	1	1313	A-G	73	81					40	0.81	0.80	0.81	0.79
"	"	MU-M	1R	1315	G-A	73	81					40	0.81	0.80	0.81	0.77
"	"	DBV	1	1316	A	73	81	59.7	317	——	319					
"	"	DBV	1A	1317	I	73	81	60.4	315	——	321					
"	"	DBV	1B	1317	F	73	81	60.3	335	63	344					
Edwards	2/19/72	DBV	1	0750	A	54	66	60.0	326	62	330					
"	"	DBV	1A	0751	D	54	66	59.5	313	——	316					
"	"	DBV	1B	0751	F	54	66	59.8	332	——	336					
"	"	MU-M	1	0755	A-G	54	66					40	0.79	0.79	0.81	0.50
"	"	MU-M	1R	0757	G-A	54	66					40	0.79	0.79	0.80	0.59
"	"	MU-M	2	1029	A-G	68	82					40	0.80	0.80	0.82	0.80
"	"	MU-M	2R	1031	G-A	68	82					40	0.79	0.79	0.81	0.64
"	"	DBV	2	1034	A	68	82	60.4	318	——	314					
"	"	DBV	2A	1035	D	68	82	60.0	310	——	310					
"	"	DBV	2B	1049	F	68	82	60.1	314	——	312					
Edmonton	2/23/72	DBV	14	1324	+A	0	——	59.8	306	——	311					
"	"	DBV	15	1336	+A	0	——	60.0	298	60	301					
"	"	MU-M	12	1336	+A	0	——					40	0.79	0.79	0.81	0.77
"	"	MU-M	13	1337	+A	0	——					40	0.79	0.79	0.80	0.76
Houston	2/25/72	MU-M	1	1000	A-G	69	——					40	0.86	0.84	0.84	0.81
"	"	DBV	1	1000	A	69	——	60.9	293	60	322					
"	"	DBV	1A	1001	D	69	——	59.5	287	59	312					
"	"	DBV	11	1537	Rubber coated	80	——	60.2	332	58	371					

Table VIII.- Basic DBV and Mu-Meter wet surface data for full stop aircraft runs.

(a) NASA Wallops Station

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER				
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING			
											INTE-GRATED AVERAGE	RECORD		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT			AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2-12-72	MU-M	3	1643	-5	A-G					40	0.76	0.79	0.81	0.45
	DBV	3	1642	-6	A	59.9	466	60	469					
	DBV	3A	1643	-5	D	60.6	560	60	623					
	DC-9	19	1645	0	A-F+									
	MU-M	4	1652	+4	A-G					40	0.79	0.81	0.82	0.34
	DBV	4	1652	+4	A	60.1	441	—	419					
	DBV	4A	1653	+5	D	59.8	418	62	420					
	MU-M	5	1712	-2	A-G					40	0.77	0.76	0.82	0.62
	DBV	5	1712	-2	A	60.2	389	62	395					
	DBV	5A	1713	-1	D	59.7	365	62	366					
	DC-9	20	1714	0	A-E+									
	MU-M	6	1717	+3	A-G					40	0.78	0.78	0.83	0.41
	DBV	6	1717	+3	A	60.3	385	63	394					
	DBV	6A	1718	+4	D	59.8	362	—	403					
	MU-M	7	1738	-4	A-G					40	0.78	0.77	0.82	0.44
	DBV	7	1738	-4	A	60.2	412	62	420					
	DBV	7A	1739	-3	D	60.2	389	63	392					
	DC-9	21	1742	0	A-E+									
	MU-M	8	1746	+4	A-G					40	0.78	0.79	0.82	0.37
	DBV	8	1746	+4	A	59.2	402	59	405					
	DBV	8A	1747	+5	D	59.1	354	62	360					

Table VIII.- Continued.

(b) Lubbock Regional Airport

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER			
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT		INTEGRATED AVERAGE	PEAK AVERAGE VALUE	PEAK MINIMUM VALUE
2-17-72	MU-M	2	1705	-5	A-G					40	0.43	0.6	0.51
	DBV	3	1708	-4	A	60.6	825	60	834				
	DBV	3A	1711	-1	B	60.1	737	60	738				
	MU-M	4		-1	A-G+								
	MU-M	3		+1	A-G					40	0.43	0.61	0.51
	DBV	2		+3	A	60.2	741	59	775				
	DBV	3A		+4	B	60.4	678	60	736				
	MU-M	3B	1715	+5	G-A					40	0.43	0.58	0.52
	MU-M	4	1735	-5	A-G					40	0.43	0.64	0.52
	DBV	5	1738	-2	A	60.7	905	59	953				
	DBV	5A	1741	-1	B	60.6	723	60	727				
	MU-M	5B	1744	+2	A-G+								
	MU-M	5	1747	+5	A-G					40	0.43	0.63	0.54
	DBV	6	1750	+8	A	62.4	814	—	930				
	DBV	6A	1753	+11	B	60.2	676	58	700				
	MU-M	6B	1756	+14	G-A					40	0.43	0.64	0.54
	MU-M	7	1806	-5	A-G					40	0.43	0.63	0.51
	DBV	8	1809	-2	A	59.9	826	59	858				
	DBV	8A	1812	+1	B	60.0	732	59	855				
	MU-M	8B	1815	+4	F	61.1	777	60	791				
	MU-M	9B	1818	+7	A-G+								
	MU-M	9	1821	+10	A-G					40	0.43	0.63	0.51
	DBV	9	1824	+13	A	59.9	796	59	828				
	DBV	9A	1827	+16	B	60.3	654	—	697				
	DBV	9B	1830	+19	F	60.3	681	—	713				
	MU-M	9B	1833	+22	G-A					40	0.43	0.62	0.49

Table VIII.- Continued.

(b) Lubbock Regional Airport

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TOUCHDOWN, SEC (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				TM-METER			
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION MEASURING DEVICE		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT		INTEGRATED AVERAGE	RUNWAY AVERAGE VALUE	RUNWAY MAXIMUM VALUE	RUNWAY MINIMUM VALUE
2-17-72	MG-M	8	1457	-2	A-G					40	0.47	0.57	0.60	0.43
	DBV	8	1458	-1	A	58.4	772	57	804					
	DBV	8A	1459	-1	D	60.5	728	60	814					
	DBV	8B	1459	-1	F	62.3	753	60	865					
	DC-9	8C	1459	0	A-G+									
	MG-M	9	1505	+4	A-G					40	0.44	0.48	0.58	0.43
	DBV	9	1506	+5	A	59.7	750	—	764					
	DBV	9A	1506	+5	D	60.3	662	—	667					
	DBV	9B	1506	+5	F	60.2	667	—	671					
	MG-M	9R	1509	+8	G-A					30	0.43	0.54	0.58	0.38
										40	0.44	0.51	0.58	0.34
2-17-72	MG-M	10	1532	-2	A-G									
	DBV	10	1533	-1	A	60.3	801	63	828					
	DC-9	10D	1533	0	A-G+									
	MG-M	11	1537	+2	A-G					40	0.50	0.54	0.60	0.44
	DBV	11	1537	+2	A	60.1	579	59	581					
	MG-M	12	1542	-2	A-G					40	0.47	0.49	0.57	0.38
	DBV	12	1542	-1	A	60.2	686	—	689					
	DBV	12A	1542	-1	D	60.3	665	62	663					
	DBV	12B	1542	-1	F	60.2	730	—	733					
	DC-9	12C	1542	0	A-G+									
	MG-M	13	1547	+3	A-G					40	0.46	0.49	0.58	0.40
	DBV	13	1547	+3	A	60.2	585	—	588					
	DBV	13A	1547	+4	D	61.0	574	—	576					
	DBV	13B	1547	+4	F	60.2	580	—	583					
	MG-M	13R	1551	+8	G-A					50	0.53	0.55	0.60	0.47

Table VIII.- Continued.

(b) Lubbock Regional Airport

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER			
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING		
											INTEGRATED AVERAGE	RECORD	
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT			AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2-18-72	MU-M	14	0836	-2	A-G					40	0.57	0.57	0.64	0.46
	DBV	14	0835	-3	A	59.9	615	—	616					
	DBV	14A	0836	-2	D	60.5	638	62	643					
	DC-9	57	0838	0	A-F+									
	MU-M	15	0841	+3	A-G					40	0.55	0.57	0.64	0.46
	DBV	15	0841	+3	A	60.0	589	—	591					
	DBV	15A	0842	+4	D	60.4	577	—	579					
	DBV	15B	0843	+5	F	60.3	625	62	628					
	MU-M	15R	0844	+6	G-A					30	0.74	0.75	0.78	0.69
	MU-M	16	0902	-2	A-G					40	0.52	0.51	0.62	0.39
	DBV	16	0902	-4	A	60.6	658	62	660					
	DBV	16A	0903	-3	D	59.6	602	—	619					
	DBV	16B	0904	-2	F	60.8	734	—	743					
	DC-9	59	0905	0	A-F+									
	MU-M	17	0907	+2	A-G					40	0.54	0.56	0.64	0.42
	DBV	17	0908	+2	A	60.2	605	—	604					
	DBV	17A	0909	+3	D	59.4	554	—	557					
	DBV	17B	0909	+3	F	60.1	561	—	567					
	MU-M	17R	0910	+4	G-A					40	0.58	0.59	0.64	0.49
	MU-M	18	0932	-3	A-G					40	0.52	0.53	0.64	0.28
	DBV	18	0930	-5	A	60.6	629	—	634					
	DBV	18A	0931	-3	D	60.1	622	—	628					
	DBV	18B	0932	-2	F	60.1	660	—	671					
	DC-9	47	0934	0	A-F+									
	MU-M	19	0936	+2	A-G					40	0.58	0.55	0.68	0.42
	DBV	19	0935	+2	A	60.1	589	—	594					

Table VIII.- Continued.

(b) Lubbock Regional Airport

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER				
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING			
											INTE-GRATED AVERAGE	RECORD		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT			AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2-18-72	DBV	19A	0937	+3	D	60.4	567	62	587					
	DBV	19B	0938	+4	F	59.8	533	—	588					
	MU-M	19R	0939	+5	G-A					50	0.50	0.50	0.60	0.32
	MU-M	20	0959	-2	A-E					40	0.47	0.47	0.54	0.29
	DBV	20	0958	-3	A	59.6	600	58	611					
	DBV	20A	0959	-2	D	59.9	596	58	614					
	DBV	20B	1000	-1	F	59.6	632	59	719					
	DC-9	48	1001	0	A-F*									
	MU-M	21	1003	+2	A-E					40	0.49	0.47	0.62	0.39
	DBV	21	1003	+2	A	59.7	564	—	571					
	DBV	21A	1004	+3	D	60.5	578	—	586					
	DBV	21B	1005	+4	F	59.9	564	—	600					
	MU-M	21R	1005	+4	G-A					30	0.68	0.68	0.75	0.46
	MU-M	22	1026	-3	A-E					40	0.52	0.50	0.63	0.35
	DBV	22	1025	-4	A	60.6	651	—	654					
	DBV	22A	1026	-3	D	60.9	632	59	654					
	DBV	22B	1027	-2	F	60.2	657	60	743					
	DC-9	60	1029	0	A-F									
	MU-M	23	1031	+2	A-E					40	0.48	0.48	0.54	0.27
	DBV	23	1030	+1	A	60.2	607	—	635					
	DBV	23A	1031	+2	D	60.3	566	62	688					
	DBV	23B	1032	+3	F	60.5	578	62	755					
	MU-M	23R	1032	+3	G-A					50	0.43	0.43	0.54	0.21
	MU-M	24	1051	-3	A-G					40	0.48	0.48	0.56	0.24
	DBV	24	1050	-4	A	60.1	655	62	679					

Table VIII.- Continued.

(b) Lubbock Regional Airport

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER				
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING			
											INTE-GRATED AVERAGE	RECORD		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT			AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2-18-72	DBV	24A	1051	-3	D	59.9	632	—	669					
	DBV	24B	1052	-2	F	60.1	644	—	779					
	DC-9	61	1054	0	A-D+									
	MU-M	25	1055	+1	A-G					40	0.45	0.45	0.72	0.32
	DBV	25	1055	+1	A	60.6	576	—	630					
	DBV	25A	1056	+2	D	60.1	537	—	649					
	DBV	25B	1057	+3	F	60.5	579	62	713					
	MU-M	25R	1057	+3	G-A					30	0.66	0.65	0.77	0.44
	MU-M	26	1120	-2	A-G					40	0.43	0.43	0.56	0.19
	DBV	26	1119	-3	A	60.3	655	59	662					
	DBV	26A	1120	-2	D	59.6	638	59	654					
	DBV	26B	1121	-1	F	60.3	704	59	776					
	DC-9	49	1122	0	A-D+									
	MU-M	27	1123	+1	A-G					40	0.45	0.45	0.59	0.33
	DBV	27	1123	+1	A	60.3	565	—	489					
	DBV	27A	1124	+2	D	60.5	598	59	734					
	DBV	27B	1125	+3	F	60.6	589	59	786					
	MU-M	27R	1126	+4	G-A					40	0.51	0.51	0.61	0.33

Table VIII.- Continued.

(c) Edwards Air Force Base

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER				
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING			
											INTE-GRATED AVERAGE	RECORD		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT			AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2/20/72	MU-M	3	0645	-2	A-G					40	0.54	0.54	0.66	0.38
	DBV	3	0645	-2	A	60.4	646	60	648					
	DBV	3A	0646	-1	D	60.0	623	58	625					
	DBV	3B	0646	-1	F	60.5	717	59	719					
	DC-9	66	0647	0	A-G+									
	MU-M	4	0650	+3	A-G					40	0.65	0.65	0.76	0.52
	DBV	4	0649	+2	A	60.0	584	59	587					
	DBV	4A	0650	+3	D	60.3	607	60	606					
	DBV	4B	0651	+4	F	60.1	678	59	673					
	MU-M	4R	0653	+6	G-A					30	0.73	0.73	0.84	0.46
	MU-M	5	0717	-3	A-G					40	0.52	0.52	0.69	0.40
	DBV	5	0716	-4	A	59.8	625	58	627					
	DBV	5A	0717	-3	D	59.5	641	60	644					
	DBV	5B	0718	-2	F	60.0	703	59	704					
	DC-9	66A	0720	0	A-D+									
	MU-M	6	0722	+2	A-G					40	0.66	0.66	0.76	0.52
	DBV	6	0721	+1	A	60.0	562	58	567					
	DBV	6A	0722	+2	D	59.6	569	59	571					
	DBV	6B	0723	+3	F	60.5	641	60	643					
	MU-M	6R	0725	+5	G-A					50	0.62	0.62	0.71	0.49
	MU-M	7	0749	-3	A-G					40	0.51	0.51	0.62	0.37
	DBV	7	0749	-3	A	60.2	663	60	670					
	DBV	7A	0750	-2	D	59.4	626	58	629					
	DBV	7B	0751	-1	F	60.0	697	60	699					
	DC-9	76	0752	0	A-E+									
	MU-M	8	0754	+2	A-G					40	0.57	0.57	0.70	0.37

Table VIII.- Continued.

(c) Edwards Air Force Base

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+)AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER				
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING			
											INTE-GRATED AVERAGE	RECORD		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT			AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2/20/72	DBV	8	0753	+1	A	59.8	627	59	629					
	DBV	8A	0754	+2	D	60.0	607	59	610					
	DBV	8B	0755	+3	F	60.7	665	59	680					
	MU-M	8R	0756	+4	G-A					40	0.59	0.59	0.74	0.40
	MU-M	9	0833	-2	A-G					40	0.48	0.48	0.47	0.47
	DBV	9	0831	-4	A	60.2	665	59	667					
	DBV	9A	0832	-3	D	59.7	626	59	631					
	DBV	9B	0833	-2	F	60.3	692	59	698					
	DC-9	77	0835	0	A-E+									
	MU-M	10	0836	+1	A-G					40	0.52	0.52	0.63	0.36
	DBV	10	0836	+1	A	60.7	674	59	679					
	DBV	10A	0837	+2	D	60.1	635	59	640					
	DBV	10B	0838	+3	F	60.4	727	59	732					
	MU-M	10R	0842	+7	G-A					30	0.65	0.65	0.77	0.29
	MU-M	11	0910	-2	A-F					40	0.41	0.41	0.54	0.24
	DBV	11	0910	-2	A	59.9	674	59	685					
	DBV	11A	0911	-1	D	60.6	686	60	697					
	DC-9	67	0912	0	A-E+									
	MU-M	12	0914	+2	A-G					40	0.48	0.48	0.55	0.33
	DBV	12	0913	+1	A	59.9	679	59	688					
	DBV	12A	0914	+2	D	60.5	637	60	658					
	DBV	12B	0915	+3	F	60.1	730	59	785					
	MU-M	12R	0916	+4	G-A					50	0.45	0.45	0.57	0.27
	MU-M	13	0958	-2	+A-F					40	0.42	0.42	0.52	0.30
	DBV	13	0958	-2	A	60.1	693	59	732					

Table VIII.- Continued.

(c) Edwards Air Force Base

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER				
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING			
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT		INTEGRATED AVERAGE	RECORD		
												AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2/20/72	DBV	13A	0959	-1	D	60.2	700	60	704					
	DC-9	68	1000	0	A-G+									
	MU-M	14	1002	+2	A-F					40	0.46	0.46	0.61	0.26
	DBV	14	1002	+2	A	59.9	695	59	724					
	DBV	14A	1003	+3	D	59.6	665	60	843					
	MU-M	14R	1004	+4	F-A+					30	0.62	0.62	0.77	0.51
	MU-M	15	1041	-3	+A-F					40	0.41	0.41	0.58	0.27
	DBV	15	1041	-3	A	60.0	711	60	715					
	DBV	15A	1042	-2	D	60.2	667	59	671					
	DC-9	70	1044	0	A-E+									
	MU-M	16	1046	+2	+A-F					40	0.48	0.49	0.64	0.34
	DBV	16	1046	+2	A	59.7	688	60	696					
	DBV	16A	1047	+3	D	60.3	679	60	728					
	MU-M	16R	1049	+5	F-A+					30	0.42	0.42	0.56	0.25
	MU-M	17	1116	-3	A-F					40	0.41	0.42	0.59	0.30
	DBV	17	1115	-4	A	60.3	709	60	717					
	DBV	17A	1116	-3	D	59.5	679	59	849					
	DC-9	80	1119	0	A-D+									
	MU-M	18	1121	+2	A-F					40	0.48	0.48	0.64	0.38
	DBV	18	1120	+1	A	60.5	697	60	717					
	DBV	18A	1121	+2	D	60.2	686	59	851					
	MU-M	18R	1124	+5	F-A					40	0.48	0.48	0.64	0.36
	MU-M	19	1230	-2	+A-F					40	0.34	0.34	0.45	0.22
	DBV	19	1228	-4	A	59.7	708	59	716					
	DBV	19A	1229	-3	D	60.5	679	60	1000					

Table VIII.- Continued.

(c) Edwards Air Force Base

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER			
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT		INTEGRATED AVERAGE	RECORD	
												AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2/20/72	DC-9	78	1232	0	A-C+								
	MU-M	20	1235	+3	+A-F					40	0.47	0.41	0.77	0.35
	DBV	20	1233	+1	A	60.0	646	60	851				
	DBV	20A	1234	+2	D	59.8	676	59	679				
	MU-M	20R	1237	+5	D-A+					30	0.61	0.61	0.78	0.51
	MU-M	21	1336	-4	+A-F					40	0.38	0.38	0.58	0.26
	DBV	21	1335	-5	A	60.4	727	60	876					
	DBV	21A	1336	-4	D	60.3	704	60	851					
	DC-9	68A	1340	0	A-C+									
	MU-M	22	1342	+2	+A-F					40	0.55	0.55	0.57	0.35
	DBV	22	1341	+1	A	60.2	625	61	820					
	DBV	22A	1342	+2	D	60.0	628	61	839					
	MU-M	22R	1344	+4	F-A+					50	0.54	0.55	0.73	0.38
	MU-M	23	1411	-3	A-F					40	0.38	0.38	0.55	0.25
	DBV	23	1410	-4	A	61.1	751	62	805					
	DBV	23A	1411	-3	D	59.1	671	60	756					
	DC-9	71	1414	0	A-D+									
	MU-M	24	1415	+1	A-F					40	0.50	0.[illegible]	[illegible]	[illegible]
	DBV	24	1415	+1	A	60.5	639	61	798					
	DBV	24A	1416	+2	D	59.7	609	59	796					
	MU-M	24R	1418	+4	F-A					40	0.53	[illegible]	[illegible]	[illegible]
	MU-M	25	1442	-2	A-F					40	0.38	0.39	0.56	0.25
	DBV	25	1442	-2	A	59.6	667	60	744					
	DBV	25A	1443	-1	D	59.8	700	60	827					
	DC-9	81	1444	0	A-D+									

Table VIII.- Continued.

(c) Edwards Air Force Base

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER				
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING			
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT		INTEGRATED AVERAGE	RECORD		
												AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2/20/72	MU-M	26	1447	+3	A-F					40	0.45	0.46	0.64	0.34
	DBV	26	1447	+3	A	60.2	687	60	673					
	DBV	26A	1448	+4	D	59.8	646	59	630					
	MU-M	26B	1452	+6	F-A					40	0.56	[illegible]	[illegible]	[illegible]

Table VIII.- Continued.

(d) Edmonton International Airport.

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER				
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING			
											INTEGRATED AVERAGE	RECORD		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT			AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2/22/72	MU-M	1	0906	-25	A-G					20	0.07	0.06	0.12	0.02
	DBV	1	0907	-14	A	20.7	121	21	122					
	DBV	1A	0908	-13	B	20.4	111	—	114					
	DBV	2	0911	-10	A	43.2	429	41	430					
	DBV	2A	0912	-9	B	37.6	277	38	279					
	MU-M	2	0913	-8	A-G					30	0.05	0.05	[illegible]	0.03
	DBV	3	0914	-7	A	50.6	568	49	571					
	DBV	4	0915	-6	A	58.6	765	60	768					
	DC-9	114	0921	0	A									
	DC-9	114A	0923	0	B-C									
	DC-9	114B	0925	0	F									
	MU-M	3	0951	-4	A-C					30	0.02	0.02	0.14	0.01
	DBV	5	0953	-2	A	60.0	761	59	764					
	DC-9	114C	0955	0	A-B+									
	MU-M	4	0956	+1	A-C					30	0.02	0.02	0.14	—
	DBV	6	0958	+3	A	60.7	811	60	812					
	MU-M	5	1555	-3	A-G					40	0.01	0.01	0.13	0.00
	MU-M	6	1558	-1	A-A					40	0.02	0.02	0.13	0.00
	DBV	7	1600	-3	D	58.9	1078	57	1082					
	DC-9	116	1605	0	D-F+									
	DBV	8	1613	-19	F	60.2	1063	60	1067					
	DC-9	117	1559	0	G-F+									
	DBV	9	1612	-4	D	59.5	1047	59	1049					
	DC-9	118	1616	0	G-D+									

Table VIII.- Continued.

(d) Edmonton International Airport

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER				
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING			
											INTE-GRATED AVERAGE	RECORD		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT			AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2/22/72	MU+M	7	1639	-3	F-A					40	0.08	0.08	0.12	0.03
	DBV	10	1640	-2	F	60.6	1090	60	1092					
	DC-9	119	1642	0	F-D+									
	MU+M	8	1656	-9	F-A					30	0.13	0.14	0.20	0.06
	DBV	11	1658	-7	F	59.7	1072	60	1074					
	DC-9	120	1705	0	F-C+									
	MU+M	9	1707	+2	F-A					20	0.19	0.20	0.26	0.10

Table VIII.- Continued.

(e) Houston Intercontinental Airport

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER				
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING			
											INTE-GRATED AVERAGE	RECORD		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT			AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2/25/72	MU-M	2	1315	-5	A-G					40	0.65	0.67	0.73	0.63
	DBV	2	1315	-5	A	61.4	433	61	438					
	DBV	2A	1316	-4	D	61.2	446	61	451					
	DC-9	102	1319	-1	A-D+									
	MU-M	3	1324	+4	A-E					40	0.73	[illegible]	[illegible]	[illegible]
	DBV	3	1321	-3	A	60.4	377	60	383					
	MU-M	3R	1334	+14	C-A					40	0.84	0.85	0.90	0.80
	MU-M	4	1343	-4	A-E					40	0.66	0.67	0.70	0.27
	DBV	4	1341	-6	A	60.1	468	59	473					
	DBV	4A	1342	-4	D	61.7	550	62	555					
	DC-9	104	1347	+1	A-G+									
	MU-M	5	1347	+1	A-F					40	0.67	0.69	0.70	0.34
	DBV	5	1347	+1	A	60.7	417	60	432					
	DBV	5A	1348	+2	D	59.8	454	58	471					
	MU-M	5R	1350	+4	F-A					40	0.74	0.77	0.78	0.42
	MU-M	6	1358	+12	A-F					40	0.67	0.68	0.69	0.34
	DBV	6	1358	+12	A	60.4	470	59	477					
	DBV	6A	1400	+14	D	59.7	484	—	507					
	DC-9	105	1403	+17	A-D+									
	MU-M	7	1409	+23	A-E					40	0.67	0.68	0.69	0.34
	DBV	7	1408	+22	A	59.6	462	59	472					
	DBV	7A	1409	+23	D	60.0	449	59	483					
	MU-M	7R	1413	+27	F-A					40	0.73	0.74	0.76	0.42
	MU-M	8	1504	+2	A-F					40	0.66	0.67	0.70	0.57
	DBV	8	1502	0	A	60.0	490	60	499					
	DBV	8A	1503	+1	D	60.4	502	59	523					

Table VIII.- Concluded.

(e) Houston Intercontinental Airport

DATE	TEST VEHICLE	RUN NO.	TIME OF TEST, HR-MIN	TIME FROM AIRCRAFT TEST, MIN (-) BEF. (+) AFTER	TEST SECTION AREA COVERED	NASA DBV				MU-METER				
						STANDARD INSTRUMENTS		PROTOTYPE INSTRUMENTS		TEST SPEED, MPH	FRICTION READING			
											INTE-GRATED AVERAGE	RECORD		
						BRAKING SPEED, MPH	STOPPING DIST., FT	BRAKING SPEED, MPH	STOPPING DIST., FT			AVERAGE VALUE	MAXIMUM VALUE	MINIMUM VALUE
2/25/72	DC-9	103	1505	0	A-E+									
	MU-M	9	1508	+3	A-E					40	0.67	0.66	0.68	0.62
	DBV	9	1507	+2	A	58.9	447	59	456					
	DBV	9A	1508	+3	D	60.1	474	60	484					
	MU-M	9R	1510	+5	F-A					40	0.67	0.68	0.72	0.66
	DBV	10	1528	—	Rubber coated	60.3	755	60	775					
	DBV	10A	1534	—	"	60.8	735	59	802					

Table IX.- Time correlated aircraft to ground vehicle data summary.

AIRPORT	RUN NO.	TYPE OF TEST	ANTI-SKID BRAKE SYSTEM	SURFACE CONDITION	AVERAGE WATER (SLUSH) DEPTH, IN.	AMBIENT AIR TEMPERATURE, °F	AIRCRAFT: GROSS WEIGHT, LB	AIRCRAFT: NASA DATA: GROUND VISUAL STOPPING DISTANCE, FT	NASA DATA: NOSE WHEEL COUNTER: STOPPING DISTANCE, FT	NASA DATA: NOSE WHEEL COUNTER: BRAKE ON GROUND SPEED, KNOTS	NASA DATA: NOSE WHEEL COUNTER: WV² LB-KTS² ×10⁻⁶	NASA DATA: NOSE WHEEL COUNTER: S.D.R.³	TOURNAS DATA: PORTABLE THEODOLITE: STOPPING DISTANCE, FT	TOURNAS DATA: PORTABLE THEODOLITE: BRAKE ON GROUND SPEED, KNOTS	TOURNAS DATA: PORTABLE THEODOLITE: WV² LB-KTS² ×10⁻⁶	TOURNAS DATA: PORTABLE THEODOLITE: S.D.R.³	GROUND VEHICLES: NASA DBV: STOPPING DIST., FT: 2-T⁴	NASA DBV: STOPPING DIST., FT: 4-T⁴	NASA DBV: S.D.R.³	MU-METER: AVERAGE FRICTION READING AT 40 MPH
WALLOPS	6	NB	MKII	DRY	—	[illegible]	[illegible]	1140	1080	109.8	9.92	—	1185	108.[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]
	5A				—			1170	1324	120.2	11.61	—	1081	112.[illegible]	[illegible]	—				
	7				—			[illegible]	[illegible]	128.[illegible]	12.90	—	[illegible]	118.[illegible]	[illegible]	—				
	1				—			1470	1448	114.9	9.08	—	1465	108.[illegible]	[illegible]	—				
	2				—			1372	1370	110.3	8.45	—	1350	108.[illegible]	[illegible]	—				
	22			MKIIIA				[illegible]	—	—	—	—	1090	104.[illegible]	[illegible]	—				
	24							[illegible]	—	—	—	—	1401	106.[illegible]	[illegible]	—				
	25							1420	—	—	—	—	1345	105.[illegible]	[illegible]	—				
	26							[illegible]	1321	111.0	8.45	—	1200	99.[illegible]	[illegible]	—				
	19			MKII	WET	0.01	74	[illegible]	4328	121.0	11.90	1.17	2220	116.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	20					0.01		2550	2330	117.0	10.[illegible]	1.17	2290	117.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	21					0.00		[illegible]	4322	114.8	9.[illegible]	1.32	2515	110.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PATUXENT	4				DRY	—		[illegible]	1112	123.5	11.39	—	1180	113.[illegible]	[illegible]	—	—	—	—	—
	13			MKIIIA		—		[illegible]	1101	121.1	10.89	—	1395	114.[illegible]	[illegible]	—				
	16			MKIIIA		—		[illegible]	[illegible]	131.[illegible]	12.20	—	1160	115.[illegible]	[illegible]	—				
	28			MKII		—		[illegible]	[illegible]	129.5	12.[illegible]	—	1780	122.[illegible]	[illegible]	—				
	29	[illegible]		MKII		—		[illegible]	[illegible]	126.9	12.09	—	1530	103.[illegible]	[illegible]	—				
	[illegible]	[illegible]		MKIIIA		—		[illegible]	[illegible]	125.[illegible]	12.[illegible]	—	1440	113.[illegible]	[illegible]	—				
	[illegible]	[illegible]		MKIIIA		—		[illegible]	[illegible]	123.[illegible]	11.89	—	1430	111.[illegible]	[illegible]	—				
	31			MKII		—		[illegible]	[illegible]	116.[illegible]	10.31	—	1300	110.[illegible]	[illegible]	—				
	32			MKII		—		[illegible]	[illegible]	107.3	8.49	—	1130	[illegible]	[illegible]	—				

NOTES: 1. DBV dry stopping distance [illegible] to 60 mph brake application speed, were temperature [illegible] and adjusted according to figure 31.

2. DBV wet stopping distance values, corrected to 60 mph brake application speed, were time correlated with aircraft run according to figure 36.

3. Aircraft SDR computed using WV² method.

MB = Maximum brake application

RT = Reverse thrust

* Data shown are from [illegible] applied up point

** Nose wheel [illegible] section

*** Spoilers not extended

**** Data shown are from brakes on point-[illegible] did not spool down until 3-[illegible] seconds after brake application

Table IX.- Continued.

AIRPORT	RUN NO.	TYPE OF TEST	ANTI-SKID BRAKE SYSTEM	SURFACE CONDITION	AVERAGE WATER (SNOW) DEPTH, IN.	AMBIENT AIR TEMPERATURE, °F	AIRCRAFT: GROSS WEIGHT, LB	AIRCRAFT: NASA DATA: GROUND VISUAL STOPPING DISTANCE, FT	AIRCRAFT: NASA DATA: MAIN WHEEL COVERED: STOPPING DISTANCE, FT	AIRCRAFT: NASA DATA: MAIN WHEEL COVERED: BRAKE ON GROUND SPEED, KNOTS	AIRCRAFT: NASA DATA: MAIN WHEEL COVERED: WV^2 LB-KTS^2 $\times 10^{-8}$	AIRCRAFT: NASA DATA: M.D.R.[3]	AIRCRAFT: DOUGLAS DATA: PORTABLE THEODOLITE: STOPPING DISTANCE, FT	AIRCRAFT: DOUGLAS DATA: PORTABLE THEODOLITE: BRAKE ON GROUND SPEED, KNOTS	AIRCRAFT: DOUGLAS DATA: PORTABLE THEODOLITE: WV^2 LB-KTS^2 $\times 10^{-8}$	AIRCRAFT: DOUGLAS DATA: PORTABLE THEODOLITE: M.D.R.[3]	GROUND VEHICLES: NASA DBV: STOPPING DIST., FT: DRY[1]	GROUND VEHICLES: NASA DBV: STOPPING DIST., FT: WET[2]	GROUND VEHICLES: NASA DBV: S.D.R.	GROUND VEHICLES: MU-METER: AVERAGE FRICTION READING AT 40 MPH
LUBBOCK	54	MB	MKIIIA	Dry	-	98	72510	1222	1286	101.2	7.72	-	1200	103.9	7.76	-					
	55	RT&MB	MKIIIA	↓		93	72[illegible]	1045	1020	109.3	8.51	-	1000	99.8	[illegible]						
	43	RT&MB	MK II	↓	-	87	[illegible]	1044	1069	106.3	7.84	-	920	94.9	6.[illegible]						
44**		MB	MK II	Wet	0.013	84	72790	3284*	4480	121.6	13.47	2.23	4800	127.1	[illegible]						
45**			MKIIIA		0.013	85	[illegible]	3264*	4609	123.7	12.42	2.76	5263	135.3	12.71						
58			MKIIIA		0.013	93	72590	2161	3717	118.2	10.19	2.72	3699	117.1	9.92	29					
46			MK II		0.013	87	72[illegible]	4775	4594	122.4	11.33	2.72					599	672	.33	.554	
110		↓	MK II		0.034	86	72[illegible]	831	751	59.7	3.00	1.68					379	472	.20	.556	
45		RT&MB	MK II		0.013	91	72790	2723	2571	121.9	11.88	1.66	2540	123.3	11.[illegible]		2[illegible]	[illegible]	[illegible]	[illegible]	
57		RT&MB	MKIIIA		0.043	91	72[illegible]	2417	2250	109.9	9.35	1.85	2275	111.0	9.[illegible]		305	365	.32	.523	
53		MB	MKIIIA		0.[illegible]	93	[illegible]	2902	2712	104.0	8.18	2.49	2730	103.3	[illegible]	.243	3[illegible]	[illegible]	.32	.573	
47			MK II		0.[illegible]	92	[illegible]	3427	3181	109.7	8.80	2.42	3180	110.1	8.97	.89	365	[illegible]	.27	.579	
48****			MK II		[illegible]	[illegible]	[illegible]	3033	3273	101.8	7.41	2.96					[illegible]	[illegible]	[illegible]	[illegible]	
49		↓	MKIIIA		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	105.0	7.69	2.81	2920	109.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
50		RT&MB	MKIIIA	↓	[illegible]			[illegible]	[illegible]	100.9	6.95	1.85	1650	[illegible]	[illegible]	[illegible]					
69		RT&MB	MK II	↓	[illegible]		[illegible]	[illegible]	1643	103.6	7.13	1.77	16[illegible]0	106.1	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	
EDWARDS	63	MB	MK II	Dry	-		[illegible]	[illegible]	1563	121.1	11.99	-	1545	[illegible]	[illegible]						
64			MKIIIA	↓	-		[illegible]	[illegible]	1390	116.8	10.96	-	1330	112.6	10.[illegible]						
65		↓	MKIIIA	↓	-		[illegible]	[illegible]	[illegible]	118.2	10.88	-	1382	116.1	[illegible]						
66			MK II		-		[illegible]	[illegible]	1777	123.7	11.62	-	1669	118.3	10.[illegible]						
64			MK II		-		[illegible]	[illegible]	1773	122.7	11.01	-	1695	118.6	[illegible]		-	-	-	-	

NOTES: 1. DBV dry stopping distance values, corrected to 60 mph brake application speed, were temperature (ambient air) adjusted according to figure 31.
2. DBV wet stopping distance values, corrected to 60 mph brake application speed, were time correlated with aircraft run according to figure 34.
3. Aircraft SDR computed using WV^2 method.

MB = Maximum brake application

RT = Reverse thrust

* Data shown are from spoilers up point
** Exited test section
*** Spoilers not extended
**** Data shown are from brakes on point-engines did not spool down until 3-4 seconds after brake application

Table IX.- Continued.

AIRPORT	RUN NO.	TYPE OF TEST	ANTI-SKID BRAKE SYSTEM	SURFACE CONDITION	AVERAGE WATER (IF ANY) DEPTH, IN.	AMBIENT AIR TEMPERATURE, °F	AIRCRAFT: GROSS WEIGHT, LB	AIRCRAFT: NASA DATA: GROUND VISUAL STOPPING DISTANCE, FT	NASA DATA: NOSE WHEEL COUNTER: STOPPING DISTANCE, FT	NASA DATA: NOSE WHEEL COUNTER: BRAKE ON GROUND SPEED, KNOTS	NASA DATA: NOSE WHEEL COUNTER: WV^2 LB-KTS^2 $\times 10^{-8}$	NASA DATA: NOSE WHEEL COUNTER: S.D.R.[3]	DOUGLAS DATA: PORTABLE TRACOLITE: STOPPING DISTANCE, FT	DOUGLAS DATA: PORTABLE TRACOLITE: BRAKE ON GROUND SPEED, KNOTS	DOUGLAS DATA: PORTABLE TRACOLITE: WV^2 LB-KTS^2 $\times 10^{-8}$	DOUGLAS DATA: PORTABLE TRACOLITE: S.D.R.[3]	GROUND VEHICLES: NASA DBT: STOPPING DIST., FT: DRY[1]	NASA DBT: STOPPING DIST., FT: WET[2]	NASA DBT: S.D.R.	GROUND VEHICLES: MU-METER: AVERAGE FRICTION READING AT 40 MPH
EDWARDS	74	MB	MK III A	Dry	-	60	308[illegible]	3241	1356	115.5	9.42	-	1280	128.3	8.40	-					
	72		MK III A			62	3[illegible]	1155	1095	110.3	8.40	-	1120	[illegible]	[illegible]	-					
	62		MK III			62	[illegible]	[illegible]	1312	116.1	8.88	-	1325	[illegible]	[illegible]	-					
	66***		MK II	wet		58	[illegible]	6074	-	124.6	12.68										
	66A		MK II			61	[illegible]	[illegible]	3383	114.1	10.39	2.18	-	-	-	-					
	76		MK III A			64	3[illegible]	3650	3730	120.6	11.32	2.45	1295	[illegible]	[illegible]	[illegible]					
	77		MK III A			62	[illegible]	3840	3804	119.4	10.76	2.63	3695	[illegible]	[illegible]	[illegible]					
	67		MK II		[illegible]	60	3[illegible]	3716	3874	114.4	9.56	2.71									
	68	RT&MB	MK II		[illegible]	64	[illegible]	-	-	128.7	11.67	-									
	70	MB	MK II			70	[illegible]	3857	3541	109.3	8.11	2.92	3475	[illegible]	[illegible]	[illegible]					
	80	MB	MK III A			74	[illegible]	[illegible]	2751	100.1	6.62	3.09	2740	[illegible]	[illegible]	[illegible]					
	78	RT&MB	MK III A			67	[illegible]	[illegible]	2006	106.6	8.64	1.82	1890	[illegible]	[illegible]	[illegible]					
	68A	RT&MB	MK II			71	[illegible]	[illegible]	1962	105.6	8.30	1.80	1860	[illegible]	[illegible]	[illegible]					
	71	MB	MK II			72	[illegible]	3258	3354	108.2	8.41	2.67	3245	[illegible]	[illegible]	[illegible]					
	81		MK III A			72	[illegible]	2754	2706	102.3	7.36	2.83	2725	[illegible]	[illegible]	[illegible]					
EDWARDS	114		MK II	Wet		58	[illegible]	-	572	70.5	1.30	2.99	545	[illegible]	[illegible]	[illegible]					
	114A					61	[illegible]	-	607	53.6	2.38	1.71	620	[illegible]	[illegible]	[illegible]					
	114B						[illegible]	-	-	-	-	-	-								
	114C						[illegible]	1850	1812	75.1	4.61	2.06	1430	[illegible]	[illegible]	[illegible]					
	115						[illegible]	1140	1097	65.4	3.38	2.57									
	117						[illegible]	1890	2003	82.9	5.98	2.52	1960	[illegible]	[illegible]	[illegible]					

NOTES: 1. DRY dry stopping distance values, corrected to 60 mph brake application speed, were temperature (ambient air) adjusted according to figure 31.
2. DBT wet stopping distance values, corrected to 60 mph brake application speed, were time correlated with aircraft run according to figure 34.
3. Aircraft SDR computed using WV^2 method.

MB = Maximum brake application

RT = Reverse thrust

* Data shown are from spoilers up point
** Exited test section
*** Spoilers not extended
**** Data shown are from brakes on point-engines did not spool down until 3-4 seconds after brake application

Table IX.- Concluded.

AIRPORT	RUN NO.	TYPE OF TEST	ANTI-SKID BRAKE SYSTEM	SURFACE CONDITION	AVERAGE WATER (SNOW) DEPTH, IN.	AMBIENT AIR TEMPERATURE, °F	AIRCRAFT										GROUND VEHICLES			
							GROSS WEIGHT, LB	NASA DATA					DOUGLAS DATA				NASA DBV STOPPING DIST., FT			MU-METER
								GROUND VISUAL STOPPING DISTANCE, FT	NOSE WHEEL COUNTER				PORTABLE TRICCOLITE				DRY[1]	WET[2]	S.D.R.	AVERAGE FRICTION READING AT 40 MPH
									STOPPING DISTANCE, FT	BRAKE OR GROUND SPEED, KNOTS	WV^2 LB-KTS^2 $\times 10^{-8}$	S.D.R.[3]	STOPPING DISTANCE, FT	BRAKE OR GROUND SPEED, KNOTS	WV^2 LB-KTS^2 $\times 10^{-8}$	S.D.R.[3]				
EDMONTON	118	MB	MKII	SNOW	0.3-0.4	-1	77550	2790	2851	93.8	6.82	2.78	2810	89.7	6.24	2.90	305	1064	3.49	—
	117		MKIIIA		0.3-0.4	-1	76990	2785	2889	108.7	9.02	3.39	2980	109.1	9.07	2.28	505	1078	2.50	0.090
	120		MKIIIA		0.3-0.4	-1	76870	2775	2841	104.5	8.20	2.60	2780	106.5	8.50	2.19	405	1087	3.01	0.110
HOUSTON	98		MKII	DRY	—	69	81310	1581	1697	119.1	11.53	—	1680	117.5	11.22	—	—	—	—	—
	100		MKIIIA		—	69	79310	1115	1189	111.2	9.86	—	1185	108.1	9.31	—	—	—	—	—
	100A		MKIIIA		—	75	76310	1020	1079	105.8	8.54	—	1075	103.9	8.24	—	—	—	—	—
	101		MKIIIA		—	76	75160	1110	1189	110.1	8.87	—	1190	109.5	8.77	—	—	—	—	—
	99		MKII		—	74	70910	1216	1266	110.7	8.69	—	1285	107.9	8.25	—	—	—	—	—
	102		MKII	WET	DAMP	87	82530	1591	1657	110.7	10.11	1.19	1635	114.0	10.73	0.99	345	580	1.13	0.718
	104****		MKIIIA		DAMP	89	80530	2210	2319	124.3	12.85	1.24	2320	128.3	13.26	1.20	338	444	1.31	0.686
	105****		MKIIIA		DAMP	87	75050	2287	2410	124.8	11.70	1.33	2345	125.1	11.78	1.39	345	468	1.40	0.670
	103****		MKII		DAMP	86	72330	2308	2414	124.6	11.23	1.44	2360	124.8	11.15	1.37	354	480	1.44	0.662

NOTES: 1. DBV dry stopping distance values, corrected to 60 mph brake application speed, were temperature (ambient air) adjusted according to figure 34.
2. DBV wet stopping distance values, corrected to 60 mph brake application speed, were time correlated with aircraft run according to figure 34.
3. Aircraft SDR computed using WV^2 method.

MB = Maximum brake application

RT = Reverse thrust

* Data shown are from spoilers up point
** Exited test section
*** Spoilers not extended
**** Data shown are from brakes on point-engines did not spool down until 3-4 seconds after brake application

Table X.- Comparison of NASA nose wheel counter, Douglas portable photo-theodolite, and USAF Askania ground phototheodolite measurements of aircraft stopping distance at discrete ground speeds at Edwards AFB.

ANTI-SKID	RUN NO.	NASA		DOUGLAS		USAF	
		DISTANCE, FT	SPEED, KNOTS	DISTANCE, FT	SPEED, KNOTS	DISTANCE, FT	SPEED, KNOTS
MK II	62	1643	121.1*	1545	116.9*	1627	123.4*
		1285	110	1360	110	1265	110
		855	90	910	90	855	90
		525	70	550	70	525	70
	63	1777	123.7*	1650	118.6*	1747	126.5*
		1285	110	1345	110	1240	110
		835	90	890	90	835	90
		510	70	535	70	510	70
	64	1773	122.7*	1695	117.9*	1735	125.2*
		1290	110	1395	110	1275	110
		850	90	915	90	850	90
		525	70	550	70	525	70
MK IIIA	72	1390	116.9*	1330	112.6*	1384	118.4*
		1190	110	1260	110	1160	110
		775	90	825	90	775	90
		470	70	500	70	470	70
	73	1434	118.3*	1320	112.4*	1415	120.3*
		1180	110	1260	110	1160	110
		790	90	830	90	790	90
		475	70	495	70	475	70

*BRAKE APPLICATION SPEED

Table XI.- Dry DBV stopping distance values—NASA data 1970-71.

TEST DATE	AIRPORT	SURFACE	AMBIENT TEMP., °F	DBV S_D, FT		NOTES
				CLEAN	RUBBER	
6/13/70	Edwards	Concrete	53	316	329	C-5A test support
	"	"	64	—	340	"
9/3/70	Langley	"	82	332	356	Rubber was cleaned
2/11/71	"	"	47	280	304	
2/12/71	"	"	34	292	280	
2/12/71	"	"	34	—	287	
3/5/71	"	"	33	303	297	
5/1/71	"	"	52	289	284	
5/3/71	"	"	50	283	289	Rubber was cleaned
1/9/70	"	"	8	312	—	Rainfall rate tests
3/18/70	"	"	50	—	298	
3/30/70	"	"	38	270	282	
4/17/70	"	"	46	261	284	
5/14/70	"	"	71	331	338	
3/4/70	Patrick Henry	"	54	292	—	
3/19/70	"	"	44	286/286	—	
4/17/70	"	"	57	—	290	
4/17/70	"	"	62	257	—	
4/20/70	"	"	72	319	—	
4/20/70	"	"	72	284	—	
5/14/70	"	"	82	320/318	—	
5/20/70	"	"	70	—	343/359	
4/26/71	Wallops	Concrete Grooved	62	301	—	
	"	Concrete Ungrooved	62	346	—	
4/27/71	"	4/22 Asphalt	53	288	—	
4/29/71	"	Concrete Ungroove	72	300/326	—	
7/13/71	"	"	78	304		NASA/USAF/FAA tests
7/15/71	"	10/28 Asphalt	66	300		" " " "
9/23/70	Hamilton AFB	12/30 Asphalt	77	331/335	—	USAF request
6/22/70	Houston	8/26 Concrete	89	349	342	DC-8 incident
6/22/70	"	14/32 Concrete	92	328	339	" "
9/21/70	Lubbock	8L/26R Asphalt	84	337	343	Airport request
6/25/70	St. Thomas	9/27 Asphalt	82	Ungr. 375	Gr. 349	DC-9 incident
11/9/70	Boston	4L/32R Asphalt	49	295	292	Airport request
	"	"	49	—	287	
	"	"	49	—	315	
	"	"	49	—	315	
11/11/70	"	"	42	296	304	

Table XII.- Dry DBV stopping distance values—B-727 aircraft tests.

TEST DATE	AIRPORT	DBV RUN NO.	AMBIENT TEMP., °F	S_D, FT
9/29/71	Wallops	3	68	292
"	"	4	68	299
10/4/71	"	1	72	293
"	"	2	72	288
"	"	3	72	300
10/5/71	"	23	76	303
"	"	23A	76	303
10/7/71	Houston	1	67	300
"	"	1A	67	296
10/9/71	Edwards	1	57.5	346
"	"	1A	57.5	329
10/11/71	Sea-Tac	1	56	324
"	"	1A	56	323
"	"	18	65	329
"	"	19	65	329
"	"	Boeing	56	334
"	"	"	56	324
"	"	"	56	335
10/13/71	Lubbock	1	51.5	299
"	"	1A	51.5	302
"	"	15	73.5	310
"	"	15A	73.5	321
10/15/71	JFK	1	72	319
"	"	1A	72	310

Table XIII.- DBV dry stopping distance—FAA runway survey data.

TEST DATE	AIRPORT	SURFACE	RUN NO.	AMBIENT TEMP., °F	S_D, FT	NOTES
11/19/71	Greensboro-High Point	Asphalt	42	59	358	
			43	59	332	
			44	59	291	
			51	64	316	
			45	60	326	
			46	60	343	
			47	63	343	
			48	64	[illegible]	
			49	64	403	
			50	64	327	
[illegible]/20/71	Charlotte	Asphalt	2	54	327	Rubber coated
			3	55	310	Clean
			4	55	330	Rubber coated
			5	55	343	Rubber coated
11/21/71			21	54	335	" "
			22	54	327	" "
			23	54	298	Clean
			24	54	321	Rubber coated
11/23/71	Atlanta	Concrete	41	36	342	Rubber coated
			42	36	343	Clean
			43	35	329	Rubber coated
		Asphalt	44	35	333	Rubber coated
			45	36	370	Clean
			46	35	303	Rubber coated
			47	35	307	Rubber coated
			48	35	309	Clean
			49	35	355	Rubber coated

TEST DATE	AIRPORT	SURFACE	RUN NO.	AMBIENT TEMP., °F	S_D, FT	NOTES
11/23/71	Atlanta	Asphalt	50	35	346	Rubber coated
		Concrete	51	35	360	Rubber coated
			52	35	309	Clean
			53	35	340	Rubber coated
			54	35	374	Rubber coated
11/30/71	Jacksonville	Concrete	126	55	310	Rubber coated
			127	56	360	[illegible]
			128	57	[illegible]	[illegible]
			129	57	349	Rubber coated
			130	57	339	Rubber coated
			131	57	337	Rubber coated
12/6/71	Miami	Asphalt	146	71	322	Rubber coated
			147	71	321	Clean
			150	71	339	Rubber coated
			197	75	327	
			198	75	324	
			199	75	327	
			194	75	365	
			195	75	382	
			196	75	364	
12/13/71	New Orleans	Concrete	225	73	337	Rubber coated
			226	73	359	[illegible]
			227	73	361	Rubber coated
			243	74	353	Rubber coated
			244	74	331	Clean
			245	74	343	Rubber coated
			241	73	360	Rubber coated
			242	73	355	Clean

Table XIV.- DBV dry stopping distance—DC-9 aircraft tests.

TEST DATE	AIRPORT	RUN NO.	AMBIENT TEMP., °F	S_D, FT	NOTES
2/12/72	Wallops	1	42	305	Clean
		1A	42	308	
		2	45	309	
		2A	45	308	
2/17/72	Lubbock	1	73	320	Rubber coated
		1A	73	310	Clean
		1B	73	331	
2/19/72	Edwards	1	54	326	
		1A	54	318	
		1B	54	334	
		2	68	313	
		2A	68	310	
		2B	68	313	
2/23/72	Edmonton	14	0	308	
		15	0	298	
2/25/72	Houston	1	69	284	
		1A	69	291	
		11	80	329	Rubber coated

Table XV.- DC-9 pilot's metering valve rigging check performed at Oklahoma City (FAA) May 24, 1972 (two months after flight tests).

Configuration			Data				
				Pressure measured at wheel brake, psi			
Anti-skid control system	Brake selector switch	Anti-skid switch	Brake pressure at cockpit, psi	Right inboard wheel	Right outboard wheel	Left inboard wheel	Left outboard wheel
Mk II	Right-hand system	Off	3000	2500	2700	3000	3000
		On	3000	2300	2500	2900	2900
Mk IIIA	Left-hand system	Off	3000	2800	2900	2900	2900
		On	3000	2800	2900	2800	2800
Data taken with engine driven hydraulic pumps utilized (engines running)							

Corrective action:

Right-hand dual-servo valve (pilot's metering valve) rigging was adjusted. Brake selector switch was turned to right-hand system and using electric hydraulic boost pumps, cockpit pressure was 2900 psi and right gear wheel brake pressures 2800 psi (in tolerance).

Table XVI.- Basic vehicle, atmospheric and surface data for ground test vehicle correlation study. February 8-11, 1972; NASA Wallops Station.

DATE	TEST VEHICLE* SEQUENCE	RUN NO.	TIME OF TEST, HR-MIN	TEST RUNWAY	SURFACE CONDITIONS					AMBIENT TEMP., °F	NASA DBV		FAA DBV		USAF MU-METER		FAA MU-METER	
					TYPE	TEST SECTION	CONDITION	WATER DEPTH, IN.	TEMP., °F		BRAKING SPEED, MPH	STOPPING DISTANCE FT	BRAKING SPEED, MPH	STOPPING DISTANCE FT	TEST SPEED, MPH	μ_1***	TEST SPEED, MPH	μ_1***
2/8/72	D-1	1	1320	10	Asphalt	B-C	Dry	—	60	28	59.9	308	—	—	—	—	—	—
"	"	1A	1325	10	"	B-C	"	—	60	28	57.1	283	—	—	—	—	—	—
2/9/72		2	0748	22	Concrete	A-D	Ice	—	32	20	21.4	399	—	—	—	—	—	—
		3	0752					—			31.3	611	—	—	—	—	—	—
		3A	0755					—			40.1	391	—	—	—	—	—	—
		5	0800					—			40.0	1015	—	—	—	—	—	—
		5A	0805					—			40.2	1015	—	—	—	—	—	—
		6	0817					—			20.8	393	—	—	—	—	—	—
	D-2	1	0818					—			—	—	20	309	—	—	—	—
	M-2	1	0820					—			—	—	—	—	—	—	40	0.14
	M-1	1	0821					—			—	—	—	—	20	0.17	—	—
	D-1	7	0823					—			30.7	777	—	—	—	—	—	—
	D-2	2	0824					—	31		—	—	29	670	—	—	—	—
	M-2	2	0826	04			Dry	—			—	—	—	—	—	—	40	0.89
	M-1	2	0827	22			Ice	—			—	—	—	—	50	0.16	—	—
	D-1	8	0828					—			38.2	1077	—	—	—	—	—	—
	D-2	3	0829					—			—	—	40	1143	—	—	—	—
	M-2	3	0830					—			—	—	—	—	—	—	40	0.13
	M-1	3	0831					—			—	—	—	—	40	0.15	—	—
	D-1	9	0833					—			39.1	1116	—	—	—	—	—	—
	D-2	4	0834					—			—	—	40	1157	—	—	—	—
	M-2	4	0836					—			—	—	—	—	—	—	40	0.12
	M-1	4	0837					—			—	—	—	—	40	0.15	—	—
	D-1	10	0838					—			31.8	761	—	—	—	—	—	—
	D-2	5	0839					—		21	—	—	32	693	—	—	—	—
	M-2	5	0840					—			—	—	—	—	—	—	—	—
	M-1	5	0842					—			—	—	—	—	40	0.16	—	—
	D-1	11	0843					—			20.3	315	—	—	—	—	—	—
	D-2	6	0844					—			—	—	20	310	—	—	—	—
	M-2	6	0846					—			—	—	—	—	—	—	—	—
	M-1	6	0847					—			—	—	—	—	40	0.16	—	—
	D-1	12	0850					—			20.0	303	—	—	—	—	—	—
	D-2	7	0851					—			—	—	20	335	—	—	—	—
	M-2	7	0852					—			—	—	—	—	—	—	20	0.15
	M-1	7	0854					—			—	—	—	—	20	0.16	—	—
	D-1	13	0855					—			28.8	668	—	—	—	—	—	—
	D-2	8	0856					—			—	—	30	736	—	—	—	—
	M-2	8	0857					—			—	—	—	—	—	—	30	0.15
	M-1	8	0859					—			—	—	—	—	30	0.16	—	—
	D-1	14	0900					—			40.2	1112	—	—	—	—	—	—
	D-2	9	0901					—			—	—	40	1158	—	—	—	—

*D-1 = NASA DBV M-1 = USAF MU-METER
D-2 = FAA DBV M-2 = FAA MU-METER

**Vehicle failed to stop within test section

***μ_1 = Average friction reading

Table XVI.- Continued.

DATE	TEST VEHICLE* SEQUENCE	RUN NO.	TIME OF TEST, HR-MIN	TEST RUNWAY	SURFACE CONDITIONS					AMBIENT TEMP., °F	NASA DBV		FAA DBV		USAF MU-METER		FAA MU-METER	
					TYPE	TEST SECTION	CONDITION	WATER DEPTH, IN.	TEMP., °F		BRAKING SPEED, MPH	STOPPING DISTANCE FT	BRAKING SPEED, MPH	STOPPING DISTANCE FT	TEST SPEED MPH	μ_1 ***	TEST SPEED, MPH	μ_1 ***
2/9/72	M-2	9	0902	22	Concrete	A-D	Ice		31	31							40	0.11
	M-1	9	0903		"		"		31						40	0.15		
	D-1	15	0908		"		"		31		20.4	34						
	D-2	10	0909				Dry		40				20	35			20	0.81
	M-2	10	0910												20	0.81		
	M-1	10	0911															
	D-1	16	0912								19.2	85						
	D-2	11	0913														30	0.81
	M-2	11	0914															
	M-1	11	0915															
	D-1	17	0917								37.4	311						
	D-2	12	0918															
	M-1	12	0919															
	M-2	12	0919														20 *	0.82
	D-1	18	0921								50.6	210						
	D-2	13	0922										50	203				
	M-1	13	0923												60	0.81		
	M-2	13	0924														50	0.81
	D-1	19	0925								60.7	323						
	D-2	14	0926										60	303				
	M-1	14	0927												50	0.81		
	M-2	14	0929														60	0.72
	M-2	15	1227		Grooved	B-C	Flooded	0.1	56	38							40	0.66
	D-1	21	1229								56.1	334						
	D-2	15	1230										40	344				
	M-1	15	1231												40	0.71		
	M-2	16	1232					0.2									50	0.70
	D-1	22	1233								56.9	348						
	D-2	16	1234										40	344				
	M-1	16	1235												40	0.71		
	M-2	17	1237				Wet	0.1									50	0.70
	D-1	23	1238								62.1	423						
	D-2	17	1239										60	351				
	M-1	17	1240												40	0.71		
	M-2	18	1242				Damp	+0.01									40	0.76
	D-1	24	1243								60.6	402						
	D-2	18	1244										62	358				
	M-1	18	1245												40	0.75		
	M-2	19	1247														40	0.73
	D-1	25	1249								60.4	405						
	D-2	19	1250										59	359				

*D-1 = NASA DBV M-1 = USAF MU-METER
D-2 = FAA DBV M-2 = FAA MU-METER

***Vehicle failed to stop within test section

***μ_1 = Average friction reading

Table XVI.- Continued.

DATE	TEST VEHICLE* SEQUENCE	RUN NO.	TIME OF TEST, HR-MIN	TEST RUNWAY	SURFACE CONDITIONS					AMBIENT TEMP., °F	NASA DBV		FAA DBV		USAF MU-METER		FAA MU-METER	
					TYPE	TEST SECTION	CONDITION	WATER DEPTH, in.	TEMP., °F		BRAKING SPEED, MPH	STOPPING DISTANCE, FT	BRAKING SPEED, MPH	STOPPING DISTANCE, FT	TEST SPEED, MPH	μ_1***	TEST SPEED, MPH	μ_1***
2/9/72	M-1	19	1251	22	Grooved	B-C	Damp	< 0.01	36	38	———	———	———	———	40	0.72	———	———
	M-2	20	1313		Concrete	D	Flooded	0.1			———	———	———	———	———	———	40	0.23
	D-1	26**	1314								60.7	397						
	M-1	20	1315								———	———	———	———	40	0.33		
	M-2	21	1324								———	———	———	———	———	———		
	D-1	27**	1325								66.7	374						
	M-1	21	1326								———	———	———	———	———	———		
	D-1	28	1328								———	———	———	———	———	———		
	M-2	22	1333					0.2			21.2	47						
	D-1	29**	1334								———	———	———	———	———	———		
	M-1	22	1335								61.7	361						
	M-2	23	1341							37	———	———	———	———	———	———		
	D-1	30	1342								———	———	———	———	———	———		
	M-1	23	1343								65.3	337						
	M-2	24	1345					0.1			———	———	———	———	———	———		
	D-1	31**	1346								———	———	———	———	———	———		
	M-1	24	1347								59.4	341						
	M-2	25	1353								———	———	———	———	———	———		
	D-1	32	1354								———	———	———	———	———	———		
	M-1	25	1355								62.0	277						
	M-2	26	1402				Damp	< 0.01			———	———	———	———	———	———		
	D-1	33**	1403								60.7	163						
	M-1	26	1404								———	———	———	———	———	———		
	D-1	34	1405								41.6	219						
	M-2	27	1408								———	———	———	———	———	———		
	D-1	35**	1409								61.7	168						
	M-1	27	1410								———	———	———	———	———	———		
	D-1	36	1411								41.7	237						
	M-2	28	1414				Dry	———	58		———	———	———	———	———	———		
	D-1	37	1415					———			61.2	314						
	M-1	28	1416					———			———	———	———	———	———	———		
	D-2	38	1417					———			70.5	125						
2/10/72	D-1	39	0729	13	Asphalt	C-1		———	41	21	60.8	314						
	D-1	40	0731					———			60.2	309						
	M-2	29	0736					———			———	———	———	———	———	———		
	M-1	29	0737					———			———	———	———	———	———	———		
	D-2	29	0740					———			———	———	60	———	———	———		
	M-2	30	0742					———			———	———	———	———	———	———		
	M-1	30	0743					———			———	———	———	———	———	———		
	D-2	21	0746					———			———	———	60	———	———	———		
	M-2	31	0745					———			———	———	———	———	———	———		

*D-1 = NASA DBV M-1 = USAF MU-METER
D-2 = FAA DBV M-2 = FAA MU-METER

**Vehicle failed to stop within test section

***μ_1 = Average friction reading

Table XVI.- Continued.

DATE	TEST VEHICLE* SEQUENCE	RUN NO.	TIME OF TEST, HR-MIN	TEST RUNWAY	SURFACE CONDITIONS					AMBIENT TEMP., °F	NASA DBV		FAA DBV		USAF MU-METER		FAA MU-METER	
					TYPE	TEST SECTION	CONDITION	WATER DEPTH, IN.	TEMP., °F		BRAKING SPEED, MPH	STOPPING DISTANCE, FT	BRAKING SPEED, MPH	STOPPING DISTANCE, FT	TEST SPEED, MPH	μ_1***	TEST SPEED, MPH	μ_1***
2/10/72	M-1	31	0746	10	Asphalt	C-F	Dry	—	41	21	—	—	—	—	40	0.80	—	—
	D-2	22	0747					—	"	"	—	—	39	301	—	—	—	—
	M-2	32	0750					—	42	23	—	—	—	—	—	—	50	0.28
	M-1	32	0751					—			—	—	—	—	30	0.79	—	—
	D-2	23	0752					—			—	—	60	295	—	—	—	—
	M-2	33	0754					—			—	—	—	—	—	—	[illegible]	0.27
	M-1	33	0755					—			—	—	—	—	60	0.78	—	—
	M-2	34	0811				Wet	0.02			—	—	—	—	—	—	[illegible]	[illegible]
	D-1	41	0812								60.1	635	—	—	—	—	—	—
	M-1	34	0813								—	—	—	—	40	[illegible]	—	—
	M-2	33	0815				Ice	—			—	—	—	—	—	—	[illegible]	[illegible]
	D-1	42	0816					—			60.5	731	—	—	—	—	—	—
	D-2	24	0817					—			—	—	60	772	—	—	—	—
	M-1	35	0818					—			—	—	—	—	40	[illegible]	—	—
	M-2	36	0822					—	41	24	—	—	—	—	—	—	30	0.27
	D-1	43	0823					—			20.5	122	—	—	—	—	—	—
	D-2	25**	0824					—			—	—	60	838	—	—	—	—
	M-1	36	0825					—			—	—	—	—	20	0.29	—	—
	M-2	37	0827					—			—	—	—	—	—	—	30	[illegible]
	D-1	44	0828					—			30.3	257	—	—	—	—	—	—
	D-2	26	0828					—			—	—	30	[illegible]	—	—	—	—
	M-1	37	0829					—			—	—	—	—	30	0.30	—	—
	M-2	38	0831					—			—	—	—	—	—	—	[illegible]	[illegible]
	D-1	45	0835					—			39.9	427	—	—	—	—	—	—
	D-2	27	0836					—			—	—	40	[illegible]	—	—	—	—
	M-1	38	0837					—			—	—	—	—	40	[illegible]	—	—
	M-2	39	0837					—			—	—	—	—	—	—	—	—
	D-1	46	0838					—			50.7	[illegible]	—	—	—	—	—	—
	D-2	28	[illegible]					—			—	—	50	[illegible]	—	—	—	—
	M-1	39	0840					—			—	—	—	—	[illegible]	[illegible]	—	—
	D-1	47	[illegible]					—			59.6	991	—	—	—	—	—	—
	D-2	29**	0841					—			—	—	61	[illegible]	—	—	—	—
	D-2	30**	0842					—			—	—	59	975	—	—	—	—
	D-1	48	0847					—			59.8	885	—	—	—	—	—	—
	D-2	31	0848					—			—	—	30	[illegible]	—	—	—	—
	M-1	40	0956				Wet	0.02	44	25	—	—	—	—	40	0.23	—	—
	D-1	49	0956					—			60.1	616	—	—	—	—	—	—
	D-2	32	0957					—			—	—	60	600	—	—	—	—
	M-2	40	0957					—			—	—	—	—	—	—	40	0.77
	M-1	41	1001				Damp	0.01			—	—	—	—	40	0.78	—	—
	D-1	50	1001				"	"			60.6	821	—	—	—	—	—	—

*D-1 = NASA DBV M-1 = USAF MU-METER
D-2 = FAA DBV M-2 = FAA MU-METER

**Vehicle failed to stop within test section

***μ_1 = Average friction reading

Table XVI.- Continued.

DATE	TEST VEHICLE* SEQUENCE	RUN NO.	TIME OF TEST, HR-MIN	TEST RUNWAY	SURFACE CONDITIONS					AMBIENT TEMP., °F	NASA DBV		FAA DBV		USAF MU-METER		FAA MU-METER	
					TYPE	TEST SECTION	CONDITION	WATER DEPTH, IN.	TEMP., °F		BRAKING SPEED, MPH	STOPPING DISTANCE FT	BRAKING SPEED, MPH	STOPPING DISTANCE FT	TEST SPEED, MPH	μ_{Δ}***	TEST SPEED, MPH	μ_1***
2/10/72	D-2	33	1007	10	Asphalt	C-F	Damp	<0.01	64	25	——	——	60		——	——	——	——
	M-2	41	1011		"	"	"	"	64	25	——	——	——		——	——	——	——
	M-2	42	1012		"	"	Wet	0.02	65	29	——	——	——		——	——	40	0.39
	D-1	51	1312								40.2	151	——		——	——	——	0.51
	D-2	34	1012								——	——	40		——	——	——	——
	M-1	43	1314								——	——	——		——	——	——	——
	M-2	43	1315				Damp	0.01			——	——	——		——	——	——	——
	D-1	52	1332								39.9	151	——		——	——	——	——
	D-2	35	1317								——	——	40		——	——	——	——
	M-1	44	1342								——	——	——		——	——	——	——
	M-2	44	1343				"	.03			——	——	——		——	——	——	——
	D-1	53	1353								20.0	36	——		——	——	——	——
	D-2	36	1355								——	——	19		——	——	——	——
	M-1	64	1402								——	——	——		——	——	——	——
	M-2	45	1405				Wet	.01			——	——	——		——	——	——	——
	D-1	54	1436								19.8	33	——		——	——	——	——
	D-2	37	1436								——	——	20		——	——	——	——
	M-1	45	1437								——	——	——		——	——	——	——
	M-2	46	1447				Wet	.02	67	31	——	——	——		——	——	——	——
	D-1	55	1507								50.7	276	——		——	——	——	——
	D-2	38	1508								——	——	50		——	——	——	——
	M-1	46	1517								——	——	——		——	——	——	——
	M-2	47	1518				Wet	.01			——	——	——		——	——	——	——
	D-1	56	1552								50.0	259	——		——	——	——	——
	D-2	39	1553								——	——	50		——	——	——	——
	M-1	47	1554								——	——	——		——	——	——	——
	M-2	48	1555				Wet	.02			——	——	——		——	——	——	——
	D-1	57	1608								30.1	85	——		——	——	——	——
	D-2	40	1609								——	——	50		——	——	——	——
	M-1	48	1610								——	——	——		——	——	——	——
	M-2	49	1611				Damp	.01			——	——	——		——	——	——	——
	D-1	58	1622								30.1	81	——		——	——	——	——
	D-2	41	1623								——	——	30		——	——	——	——
	M-1	49	1624								——	——	——		——	——	——	——
2/11/72	D-2	59	0757				Dry	——	42	24	30.9	76	——		——	——	——	——
	M-2	62	0758								——	——	30		——	——	——	——
	D-1	60	0830								30.2	78	——		——	——	——	——
	M-2	63	0831								——	——	30		——	——	——	——
	D-2	61	0832								30.8	143	——		——	——	——	——
	D-1	61	0834								——	——	40	134	——	——	——	——
	M-1	62	0835								30.4	217	——		——	——	——	——

*D-1 = NASA DBV
D-2 = FAA DBV
M-1 = USAF MU-METER
M-2 = FAA MU-METER

**Vehicle failed to stop within test section

***μ_1 = Average [illegible]

Table XVI.- Concluded.

DATE	TEST VEHICLE* SEQUENCE	RUN NO.	TIME OF TEST, HR-MIN	TEST RUNWAY	SURFACE CONDITIONS					AMBIENT TEMP., °F	NASA DBV		FAA DBV		USAF MU-METER		FAA MU-METER	
					TYPE	TEST SECTION	CONDITION	WATER DEPTH, in.	TEMP., °F		BRAKING SPEED, MPH	STOPPING DISTANCE, FT	BRAKING SPEED, MPH	STOPPING DISTANCE, FT	TEST SPEED, MPH	μ_1***	TEST SPEED, MPH	μ_1***
2/11/72	D-2	45	0735	10	Asphalt	C-F	Dry	—	42	26	—	—	50	217	—	—	—	—
	D-1	63	0738					—			60.7	336	—	—	—	—	—	—
	D-2	46	0740					—			—	—	60	—	—	—	—	—
	M-1	50	0744					—			—	—	—	—	40	0.81	—	—
	M-2	50	0745					—			—	—	—	—	—	—	—	0.81
	D-2	47	0747					—			—	—	52	273	—	—	—	—
	M-2	51	0758	22	Grooved	C-F		—	40	27	—	—	—	—	—	—	—	—
	D-1	64	0759					—			59.3	291	—	—	—	—	—	—
	D-2	48	0800					—			—	—	41	27	—	—	—	—
	M-1	51	0801					—			—	—	—	—	—	—	—	—
	M-2	52	0804					—			—	—	—	—	—	—	—	—
	M-1	52	0805					—			—	—	—	—	—	—	—	.79

*D-1 = NASA DBV
D-2 = FAA DBV
M-1 = USAF MU-METER
M-2 = FAA MU-METER

**Vehicle failed to stop within test section

***μ_1 = Average friction reading

Table XVII.- Evaluation of 2-inch by 1/4-inch by 1/4-inch groove pattern at Houston Intercontinental Airport.

TESTS BEFORE GROOVING - JUNE 1970
TEST VEHICLE: NASA DBV

WETNESS CONDITION	WATER DEPTH, IN.	WET/DRY STOPPING DISTANCE RATIO	
		TOUCHDOWN ZONE (GROOVE COATED)	BRAKING ZONE (CLEAN)
WET	[illegible]	[illegible]	2.42
DAMP	[illegible]	[illegible]	1.88

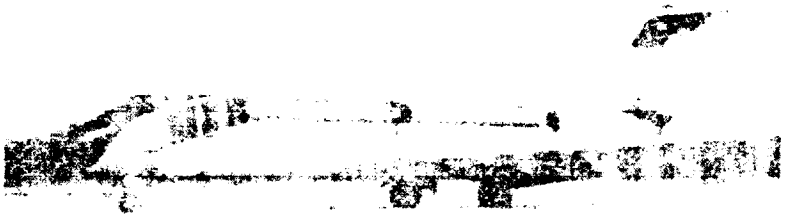
[illegible] GROOVING - OCTOBER 1971
[illegible]7, NASA DBV, AND FAA MU-METER

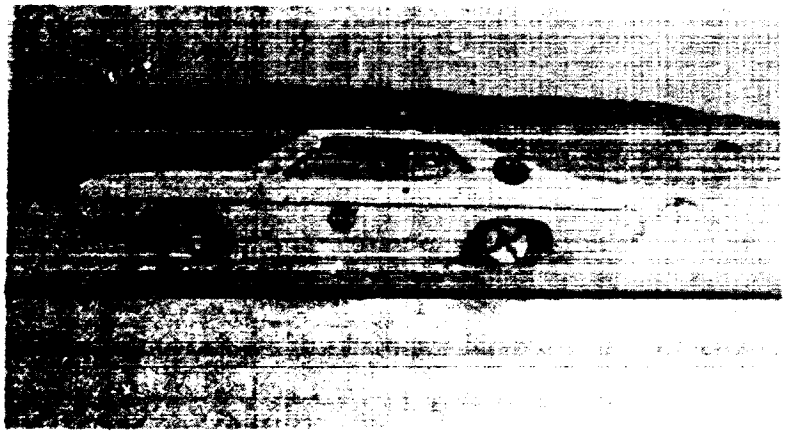
WETNESS CONDITION	WATER [illegible]	WET/DRY STOPPING DISTANCE RATIO	
		[illegible]7	NASA DBV
WET	[illegible]	[illegible]2	2.37
WET	[illegible]	[illegible]1	2.08
WET	[illegible]	[illegible]	2.29

[illegible] GROOVING - FEBRUARY 1972
[illegible], NASA DBV, AND USAF MU-METER

[illegible]	W[illegible]	[illegible] STOPPING DISTANCE RATIO	
			NASA DBV
DAMP	[illegible]	[illegible]0	1.13
WET	[illegible]	[illegible]4	1.31
WET	[illegible]	[illegible]2	1.40
WET	[illegible]	[illegible]4	1.44

(a) DC-9 test aircraft





(b) NASA DBV

(c) Towing vehicle and Mu-Meter

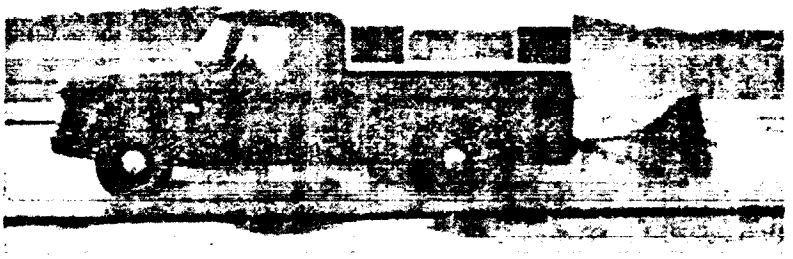


Figure 1.- Test aircraft and ground vehicles.

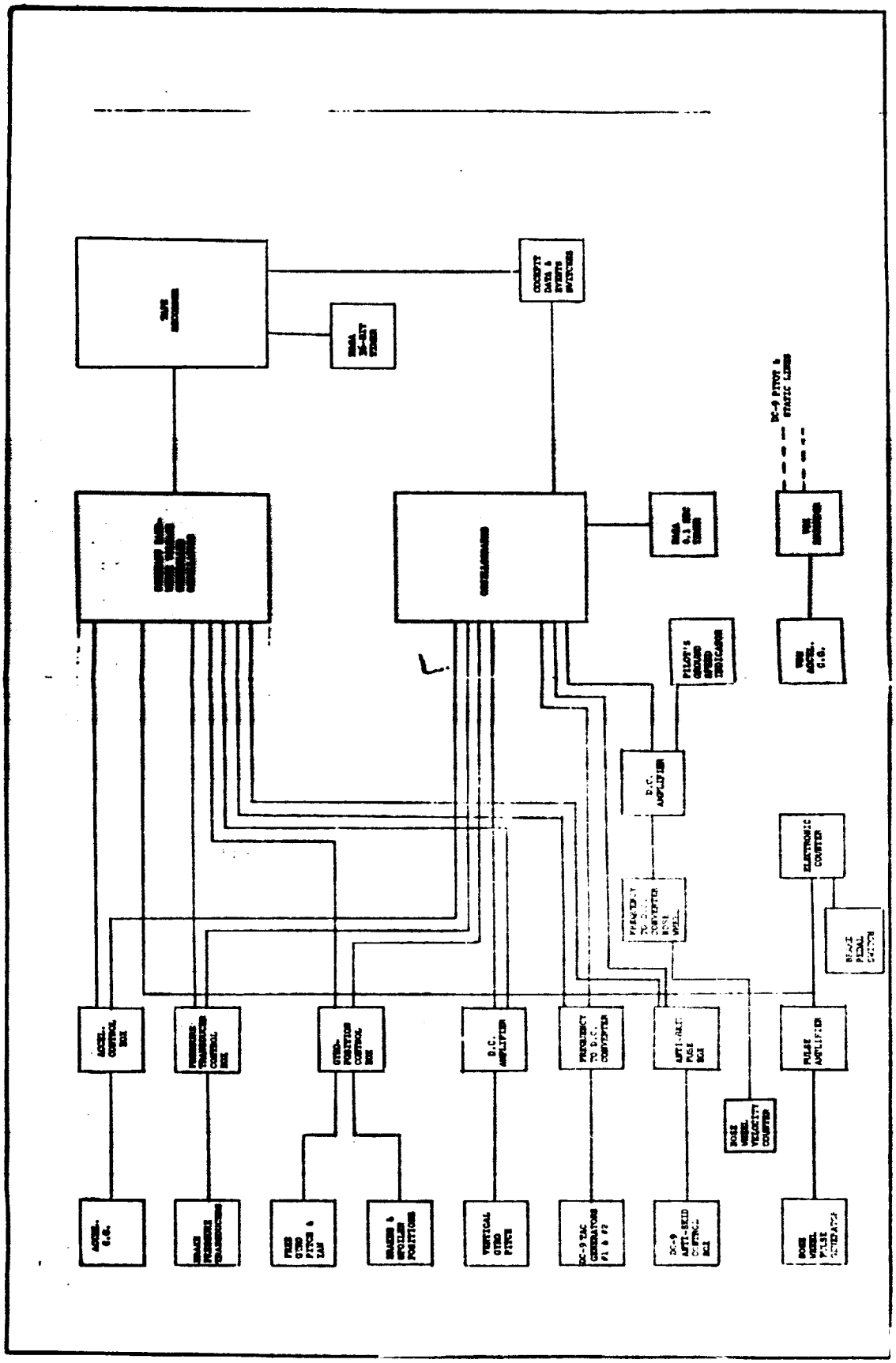
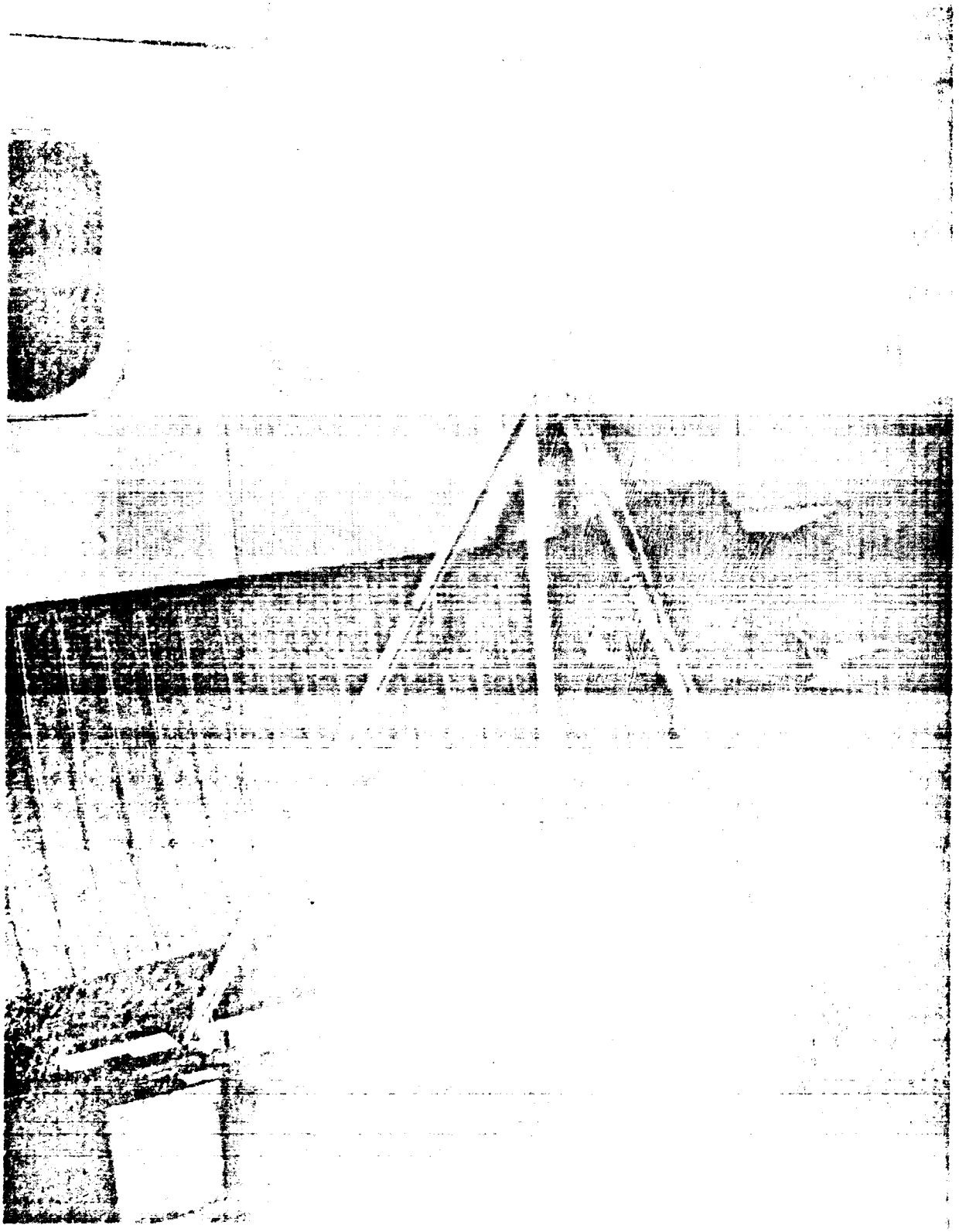
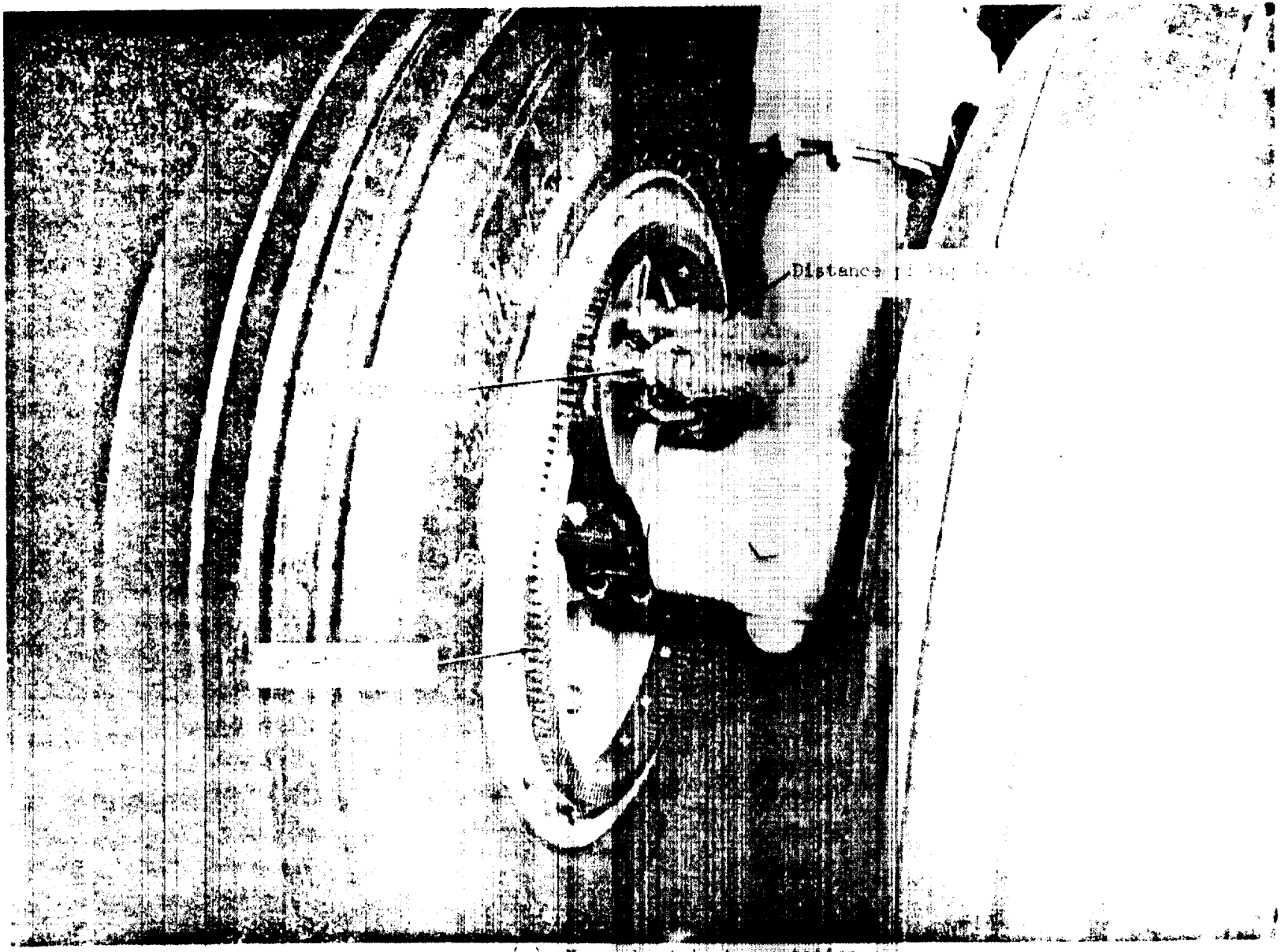


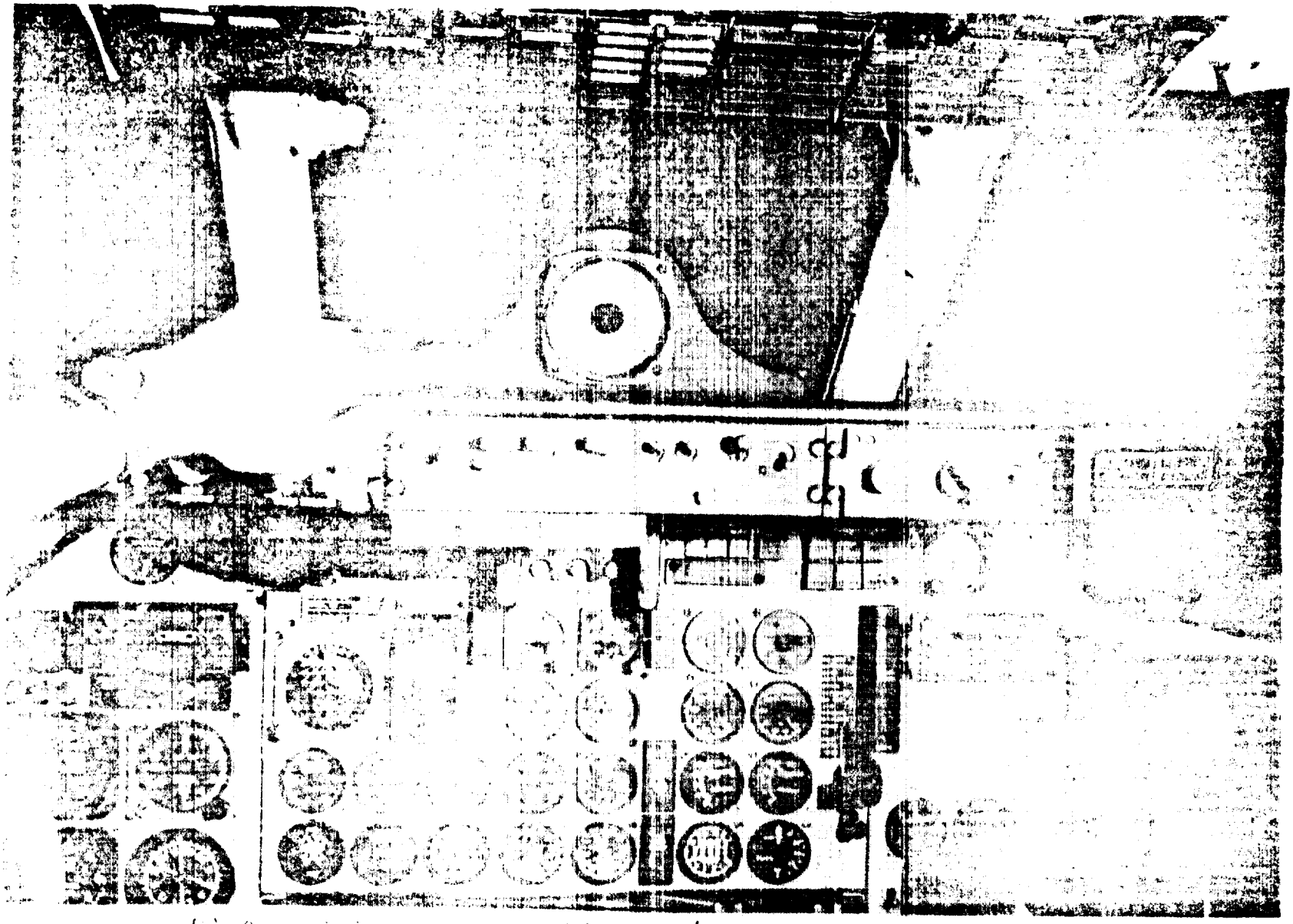
Figure 2.- Signal block diagram for NASA instrumentation on DC-9.





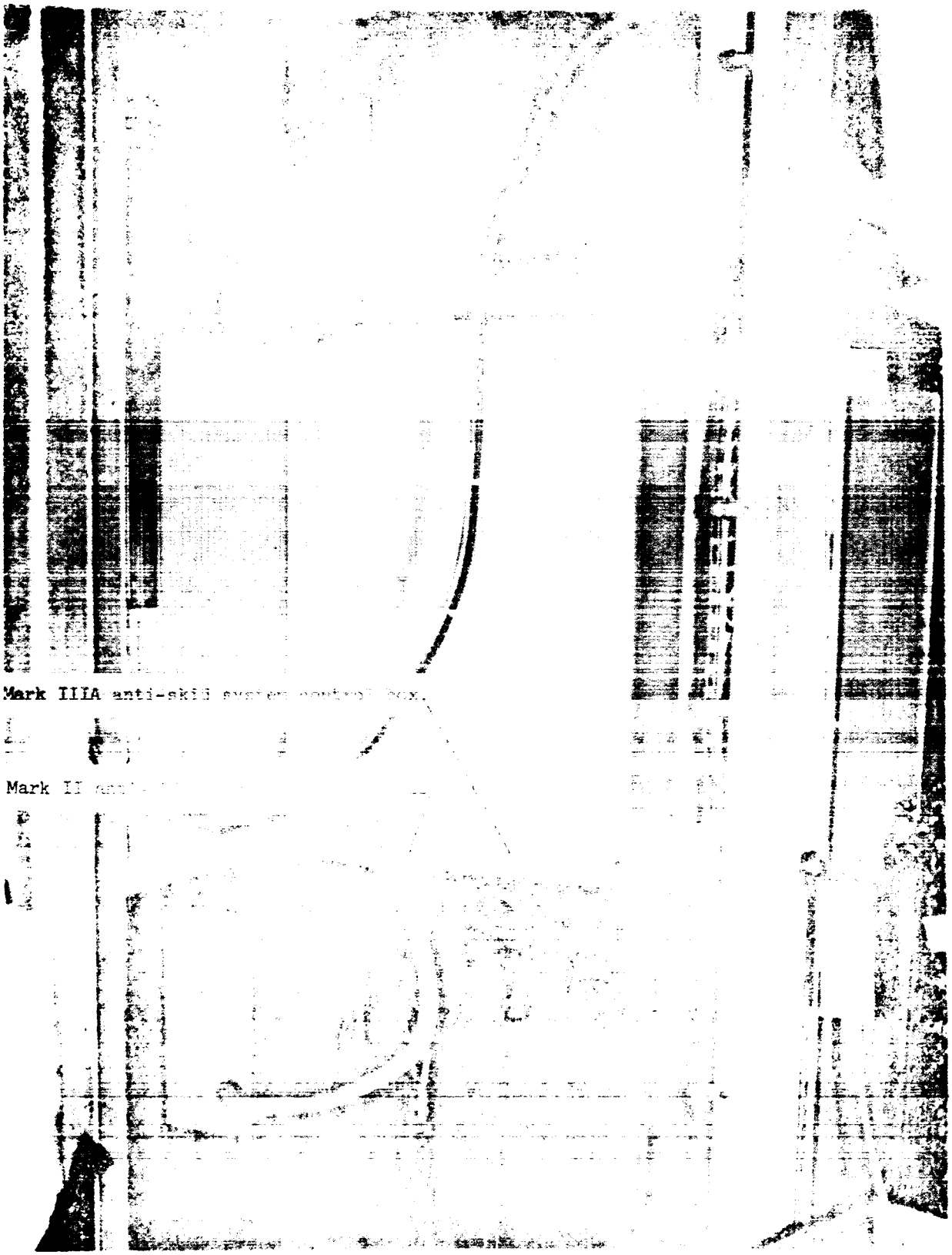
(a) Nose wheel instrumentation.

Figure 5.- NASA nose wheel instrumentation on DC-9 aircraft.



(e) [illegible] indicator (nose wheel velocity calibrated in knots).

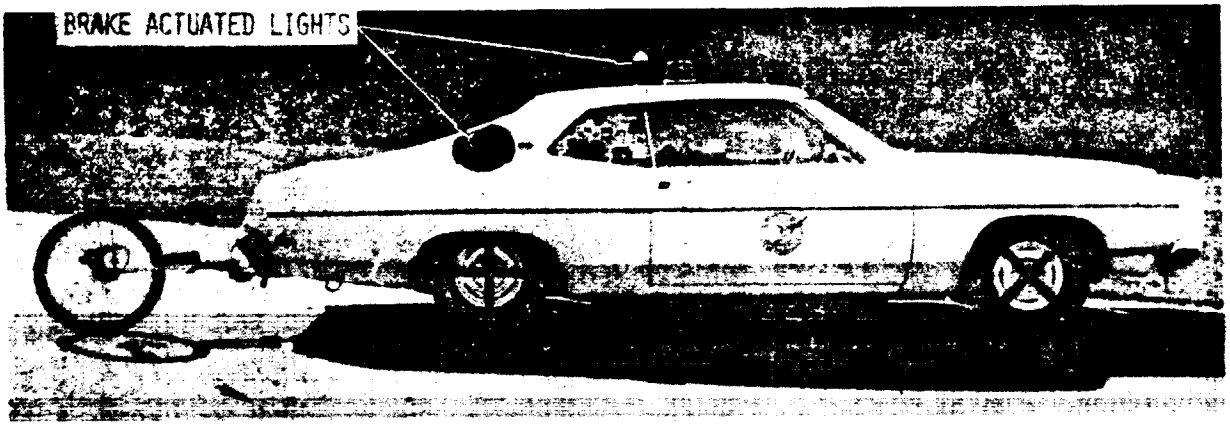
Figure 5.- Concluded.



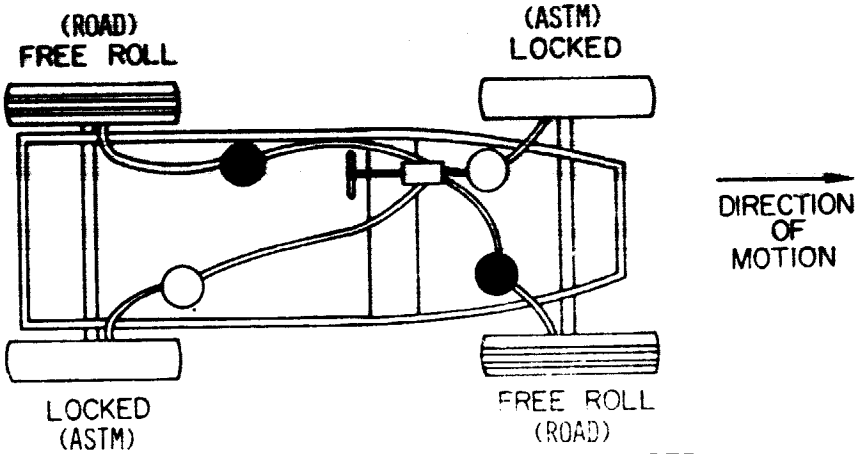
Mark IIIA anti-skid system control box.

Mark II

Fixur



(A) NASA DIAGONAL-BRAKED VEHICLE

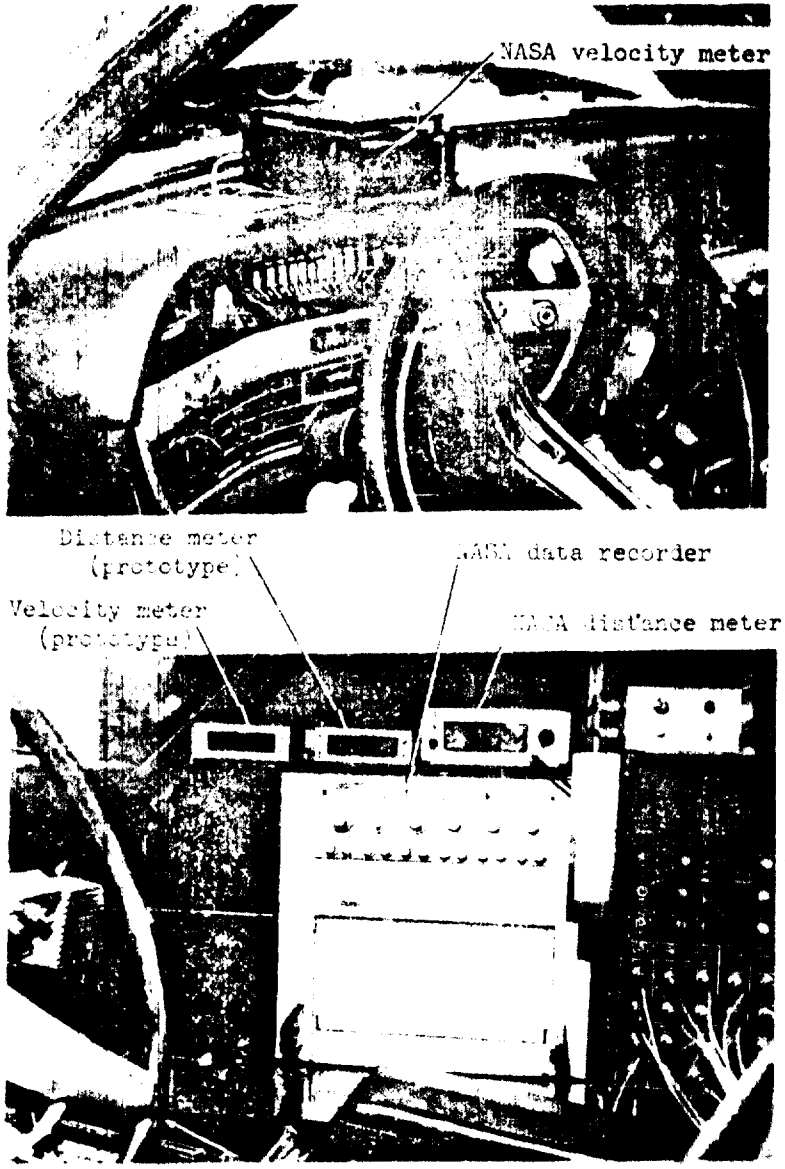


● VALVE CLOSED; BRAKES CANNOT BE ACTUATED

○ VALVE OPEN; BRAKES CAN BE ACTUATED

(B) SCHEMATIC OF DIAGONAL-BRAKING SYSTEM

Figure 7.- Diagonal-braking system.



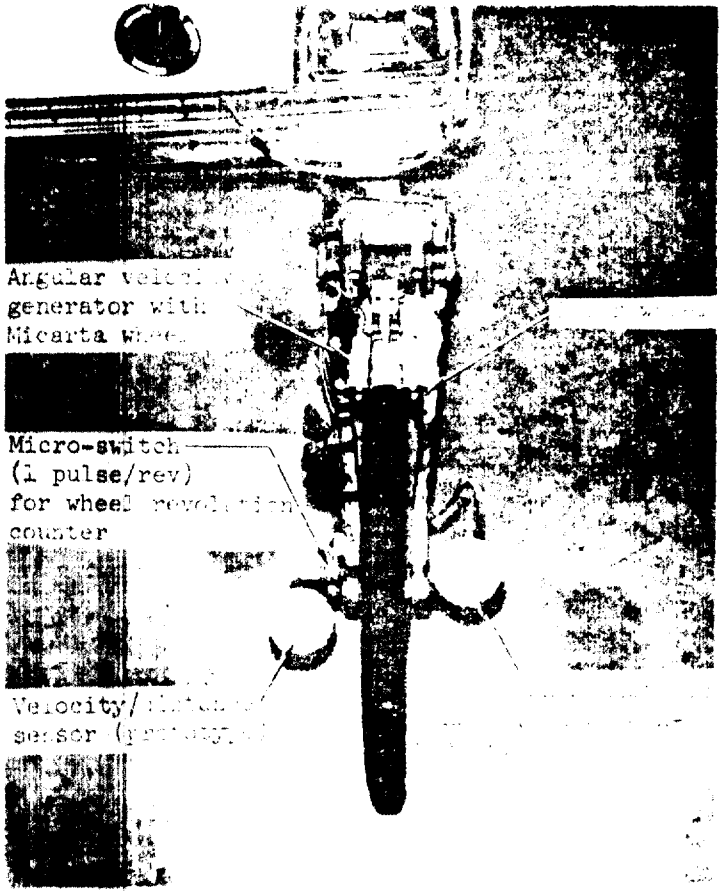
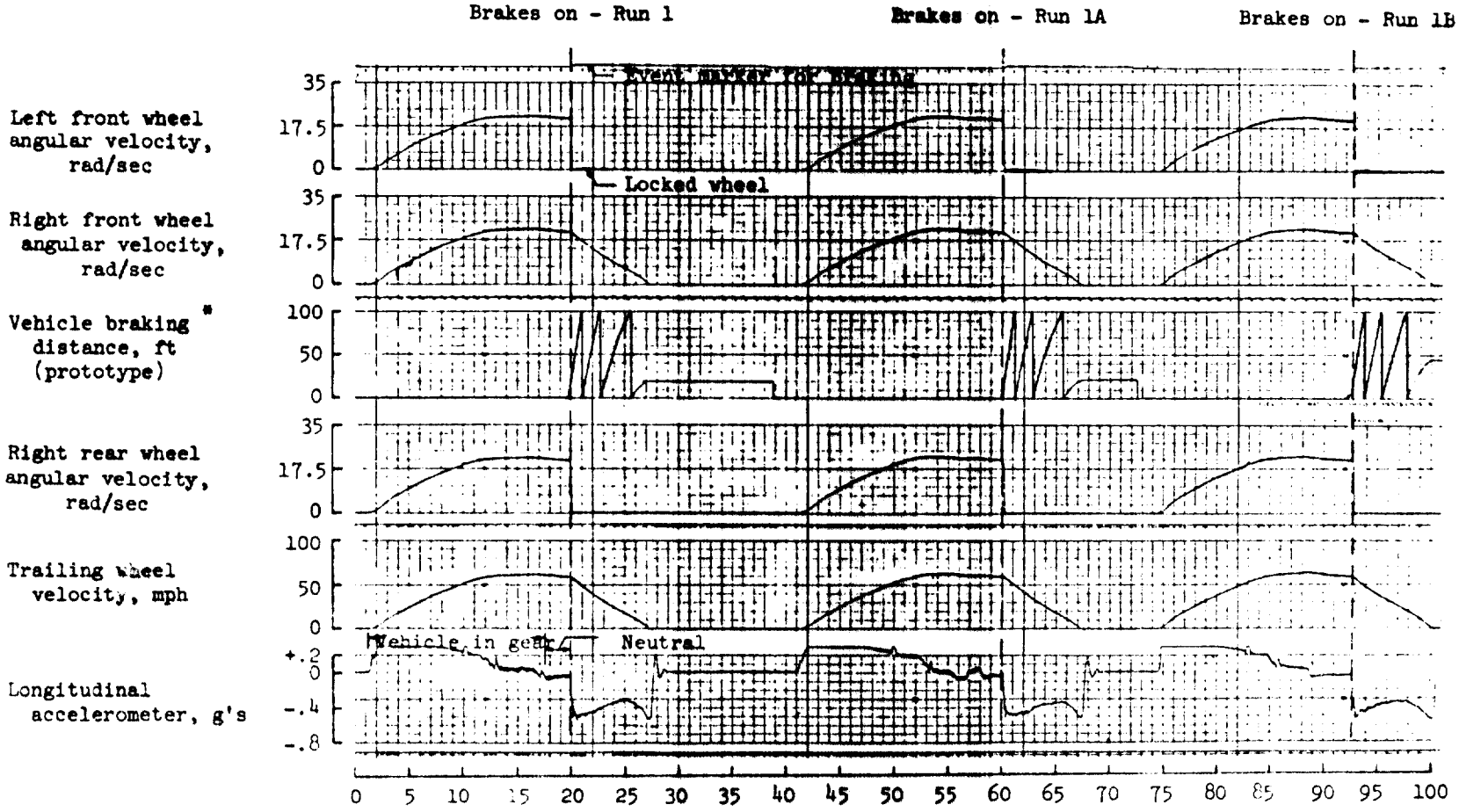


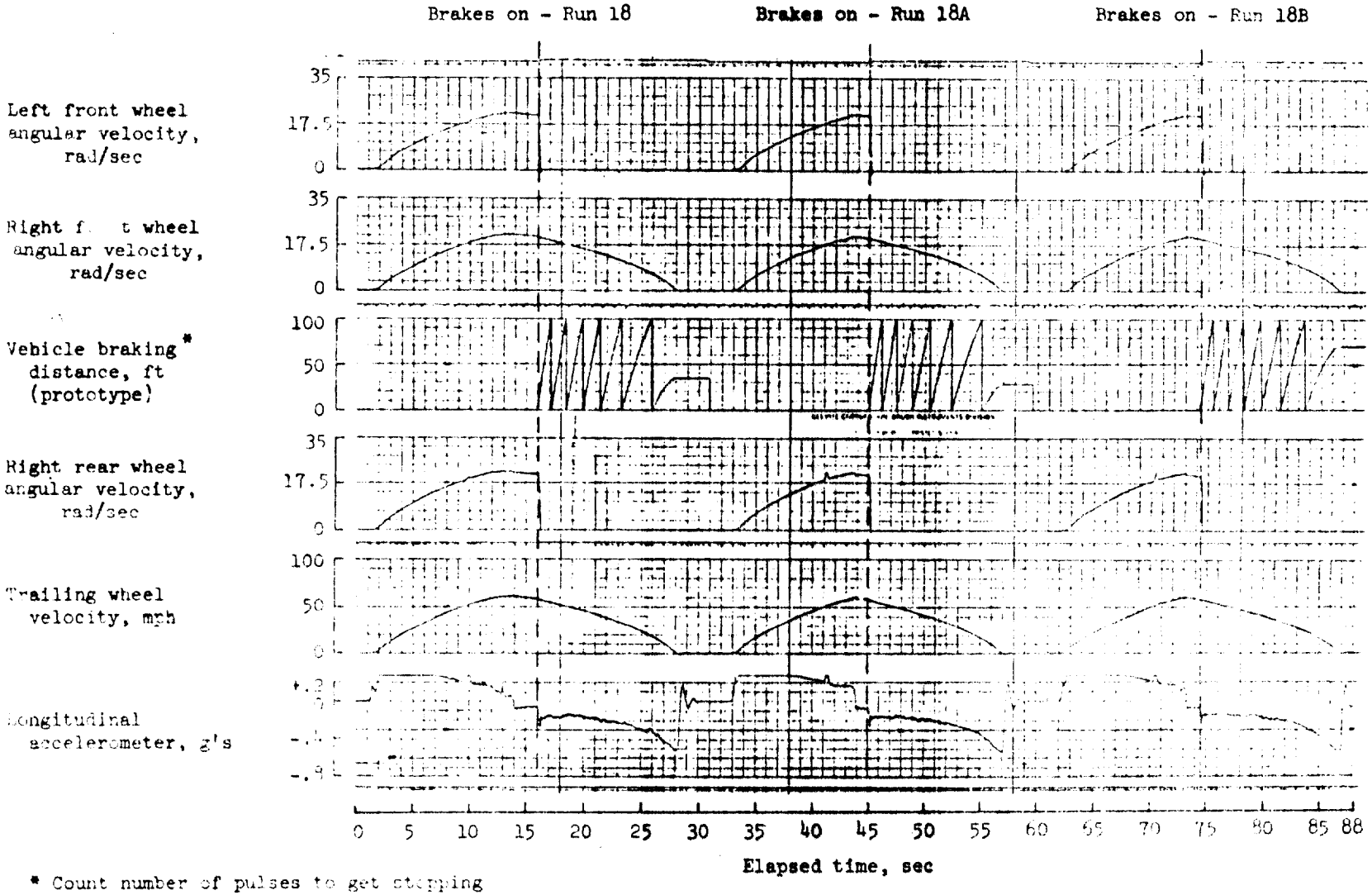
Figure 8.- NASA DBV instrumentation.



* Count number of pulses to get stopping distance - i.e. run # 15 = 320 feet

(a) DBV dry run series.

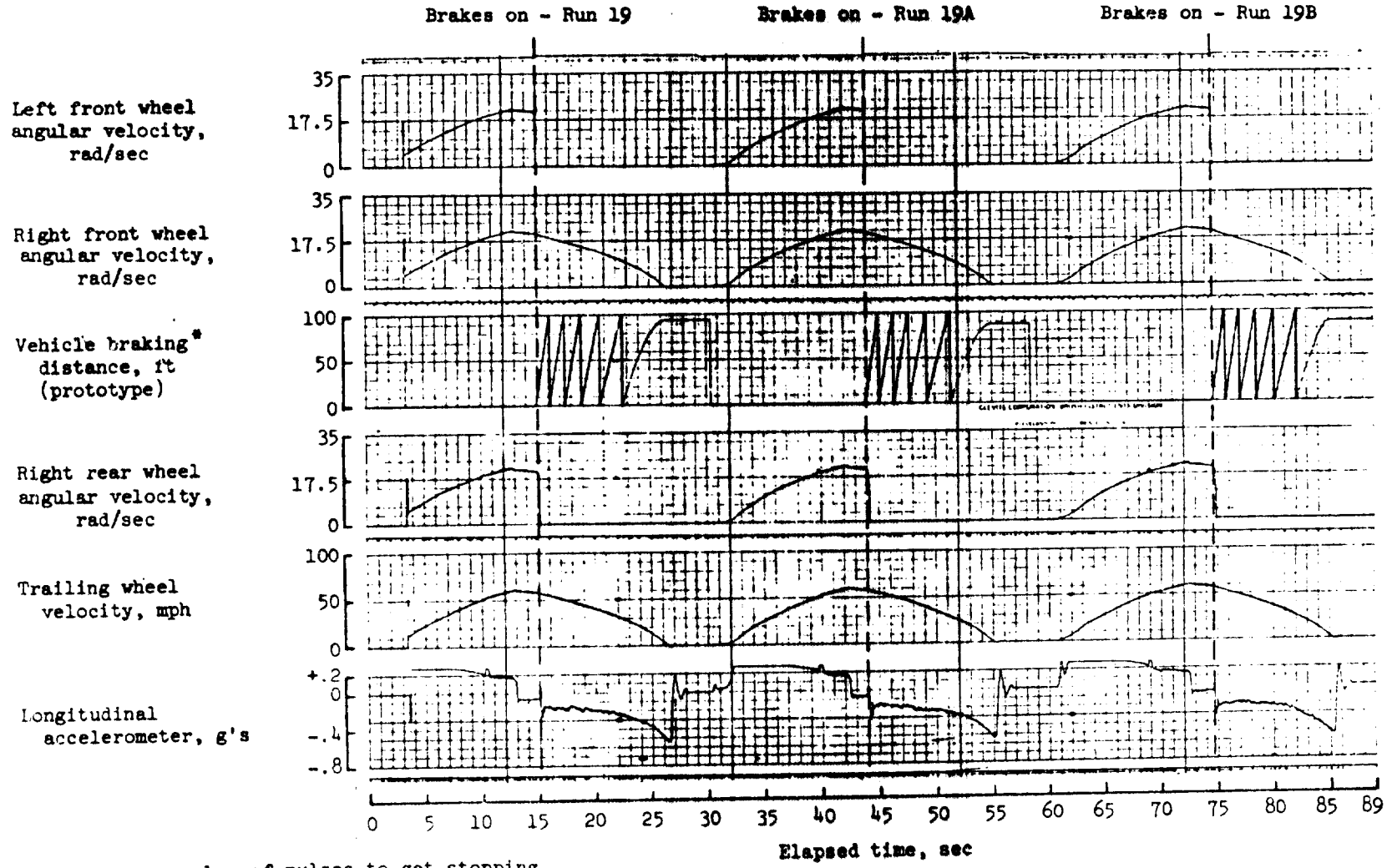
Figure 9. Sample NASA DBV records of test runs performed during DC-9 aircraft flight test program on runway 8L/26R at Lubbock Regional Airport.



* Count number of pulses to get stopping distance - i.e. run # 18B = 53 feet

(b) DBV wet run series before aircraft run 47

Figure 9.- Continued.



* Count number of pulses to get stopping distance - i.e. run # 195 = 594 feet

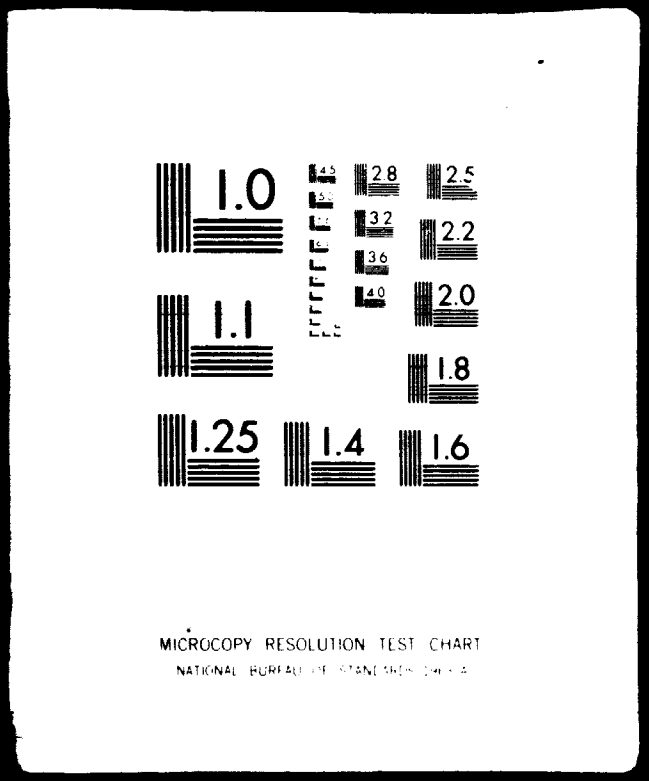
(c) DBV wet run series after aircraft run 47.

Figure 9.- Concluded.

- Runway friction meter (

2 OF 4

N77 27133 UNCLAS



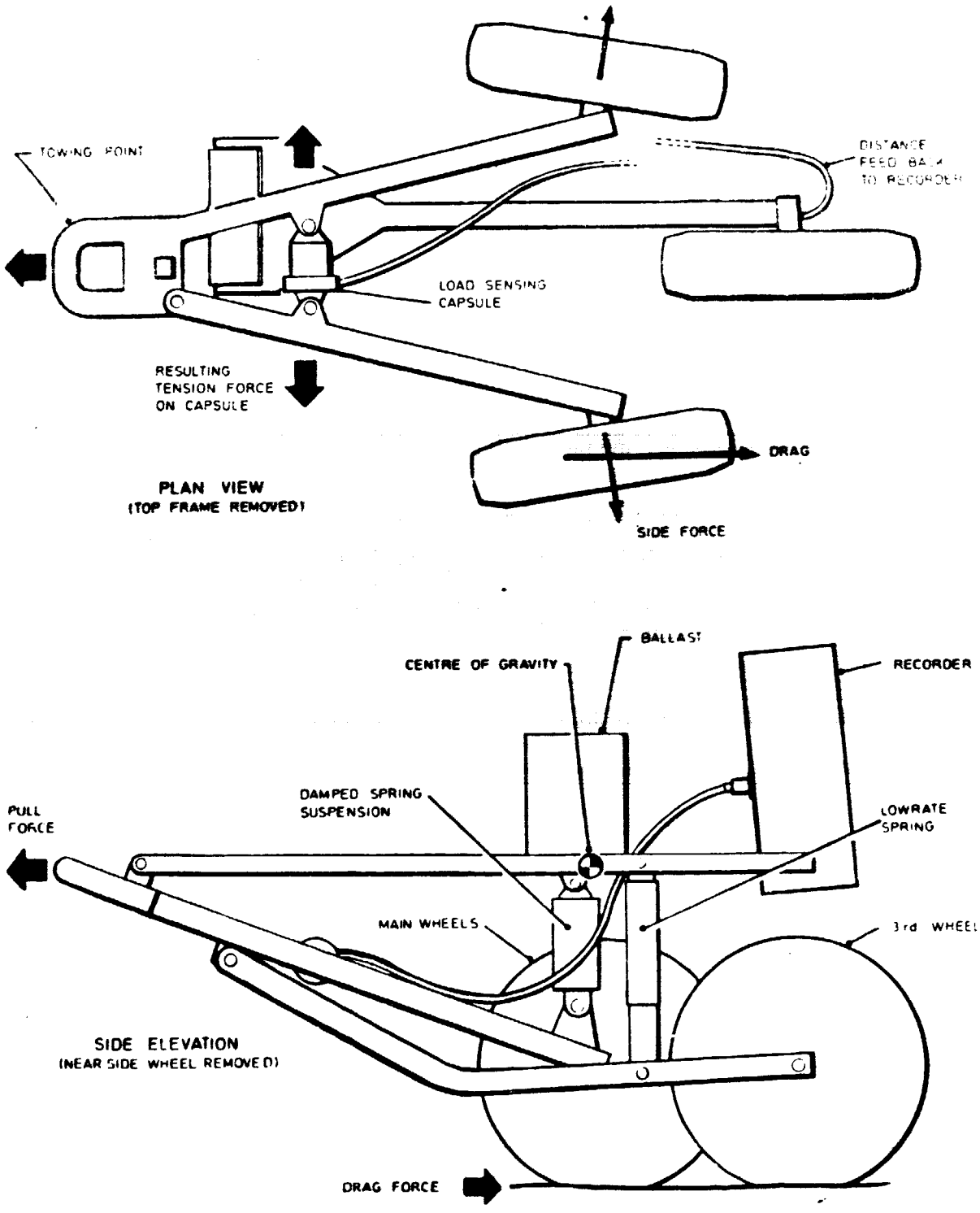


Figure 11.- Diagrammatic layout of Mu-Meter

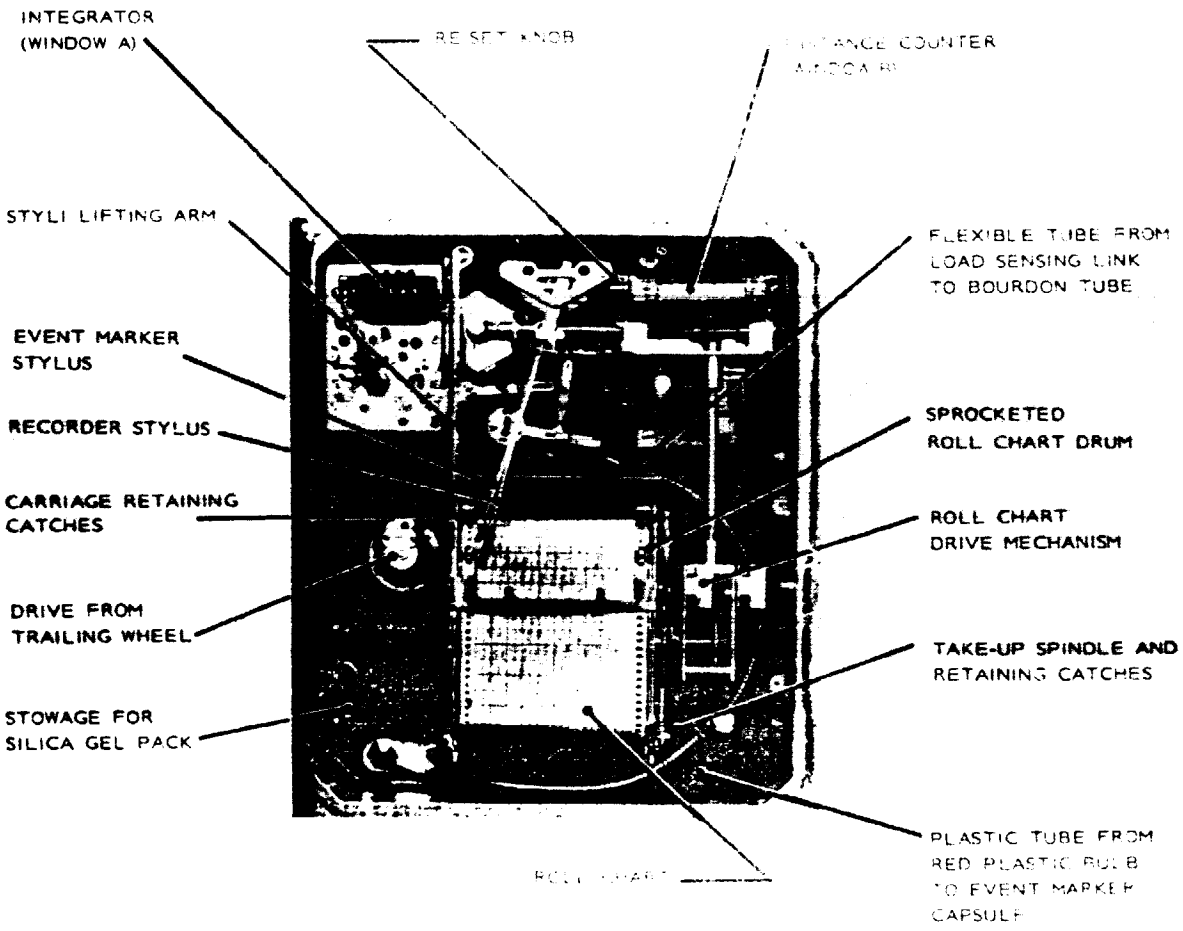
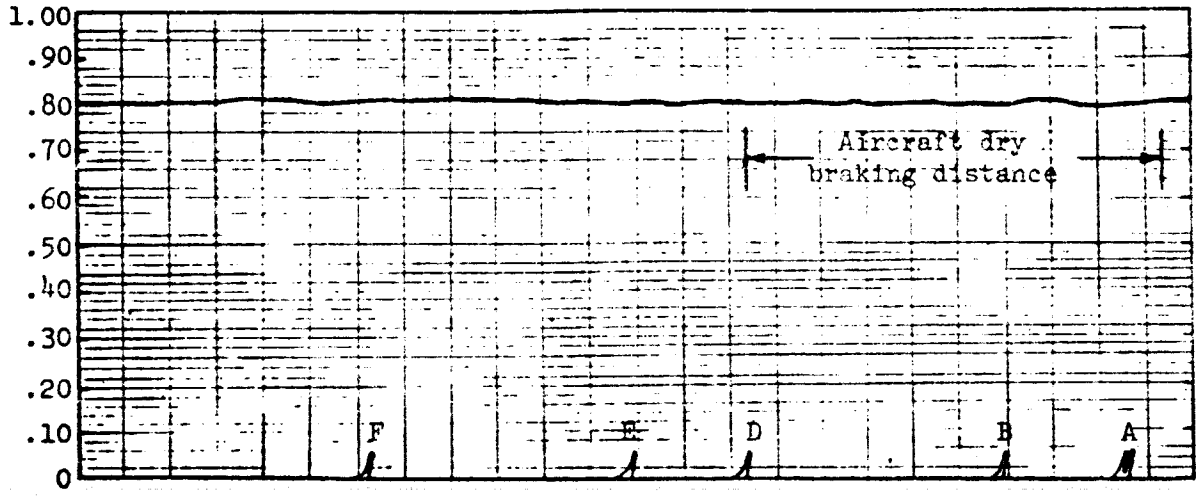
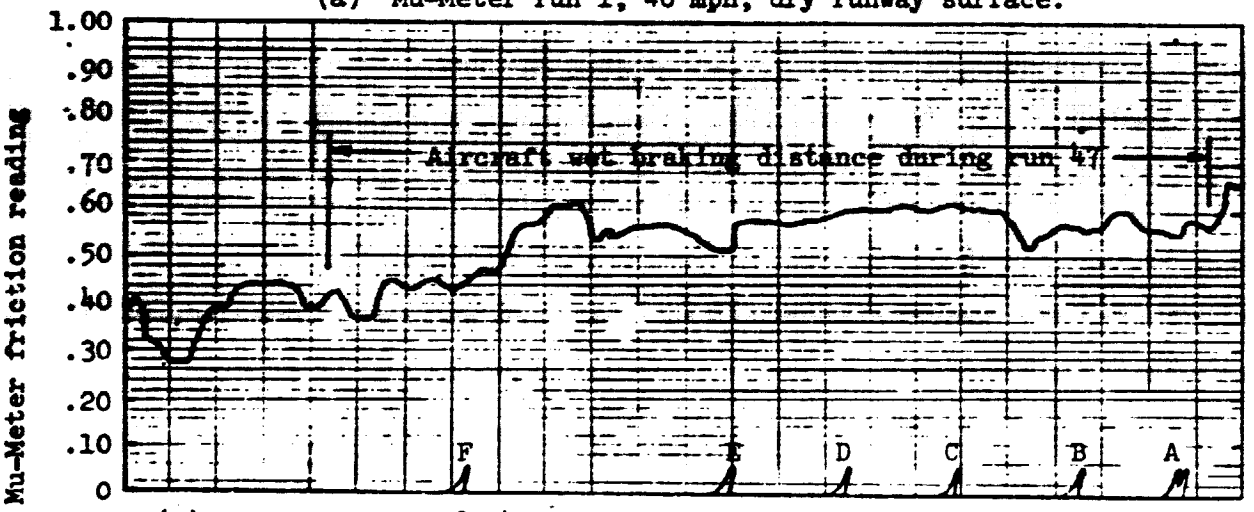


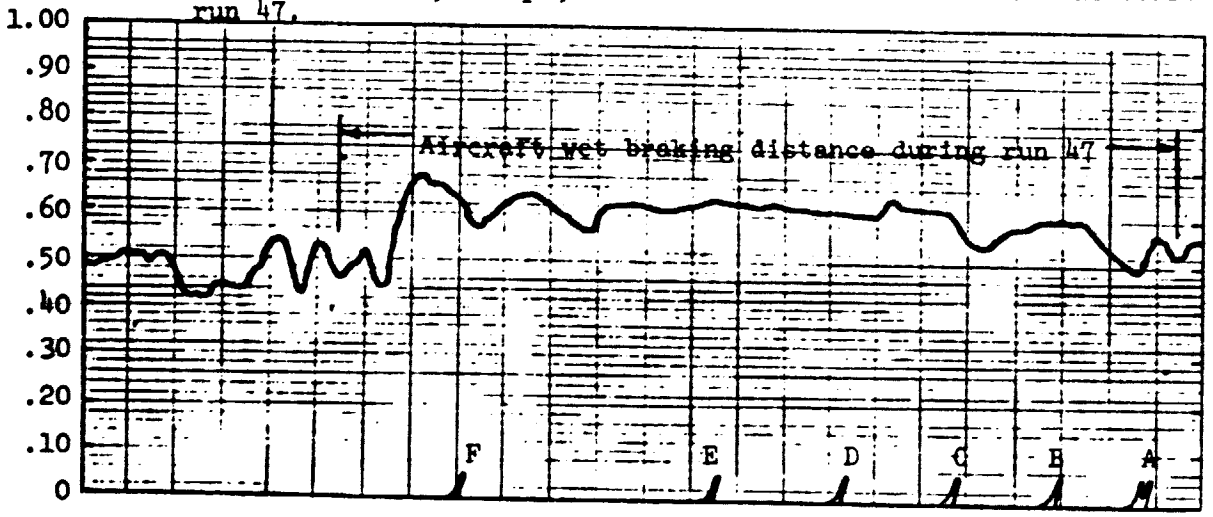
Figure 12.- Mu-Meter instrumentation



(a) Mu-Meter run 1; 40 mph; dry runway surface.



(b) Mu-Meter run 18; 40 mph; conducted three minutes before aircraft run 47.



(c) Mu-Meter run 19; 40 mph; conducted two minutes after aircraft run 47.

Figure 13.- Typical Mu-Meter records of test runs performed during DC-9 aircraft flight test program on runway 8L/26R at Lubbock Regional Airport.

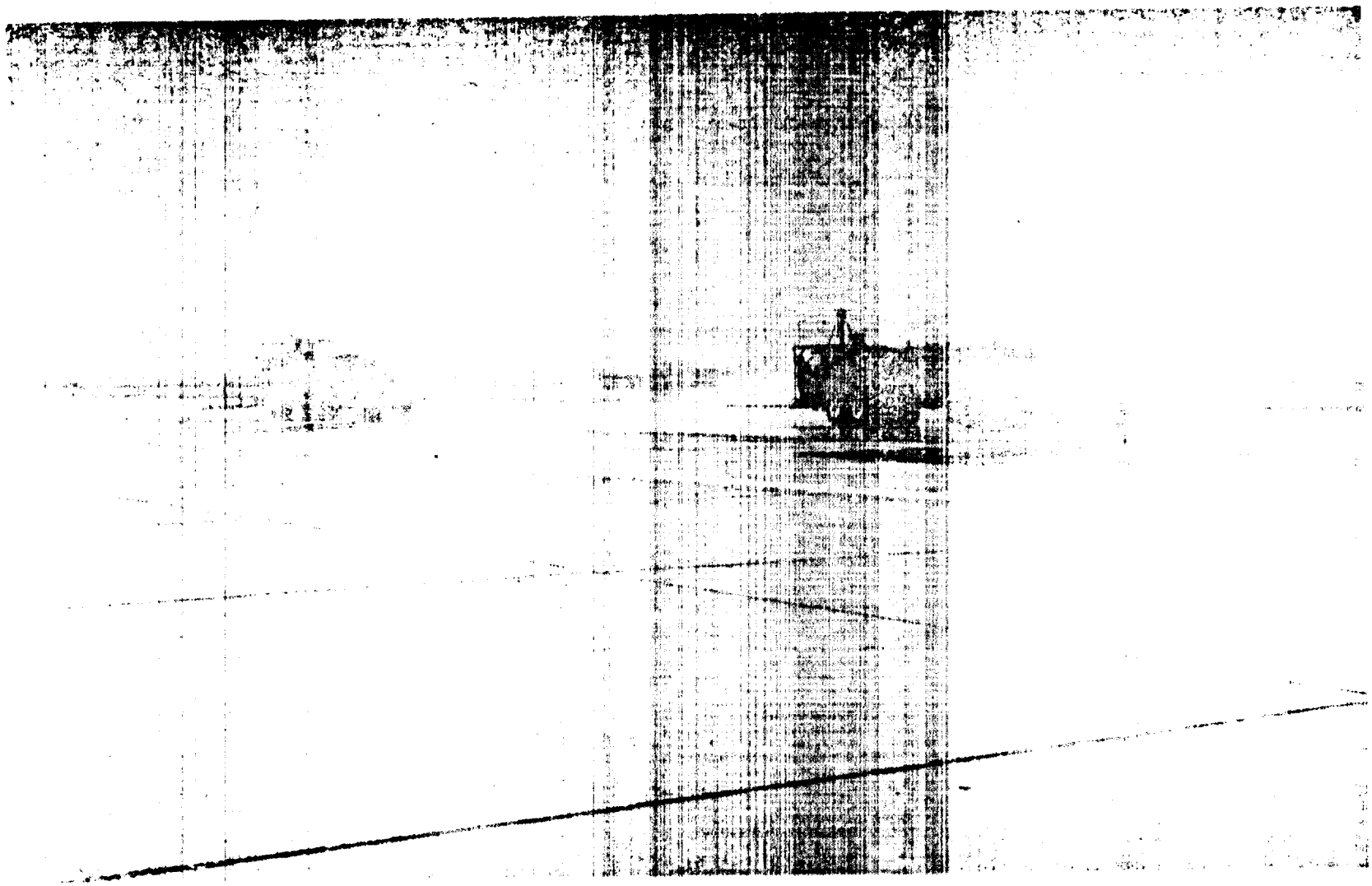


Figure 14.- Typical runway wetting equipment and operation during testing at Edwards AFB.

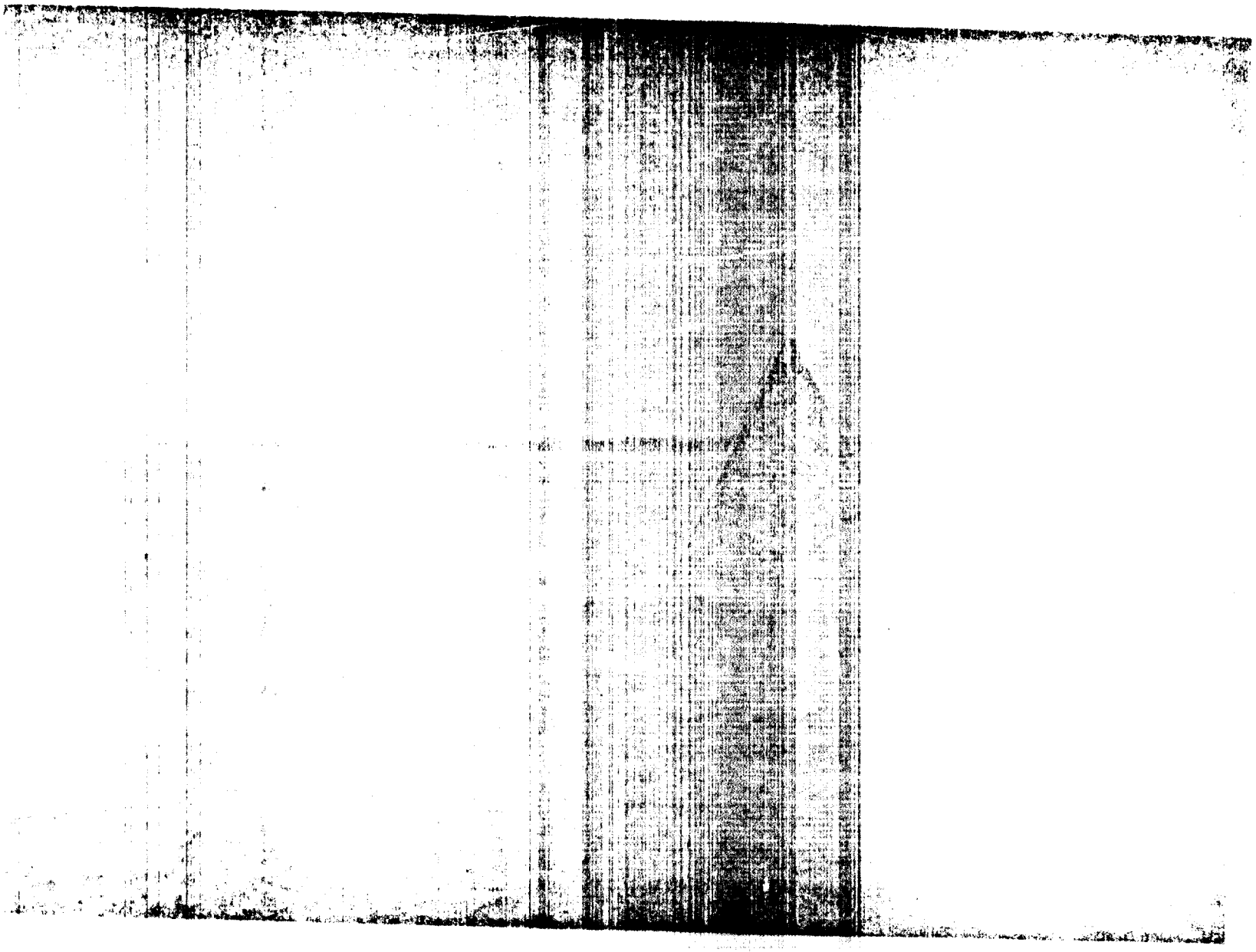
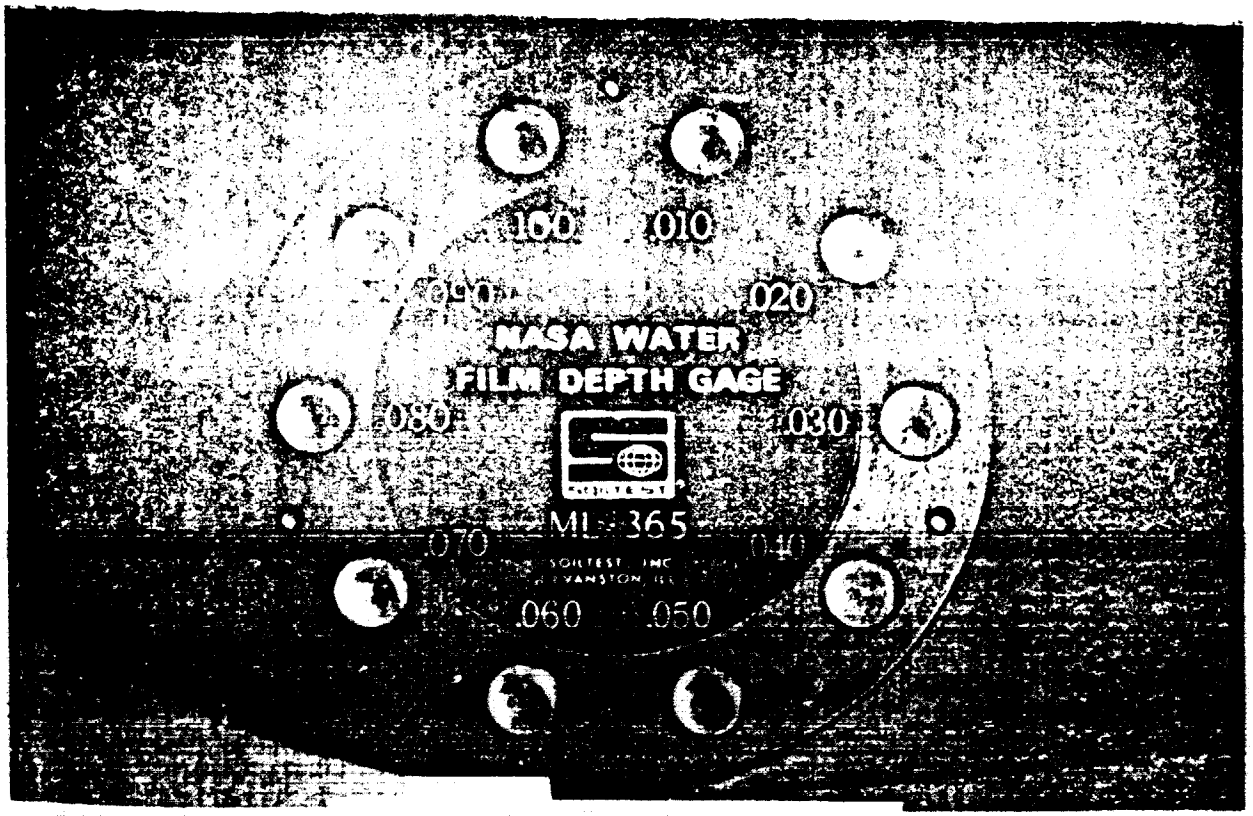
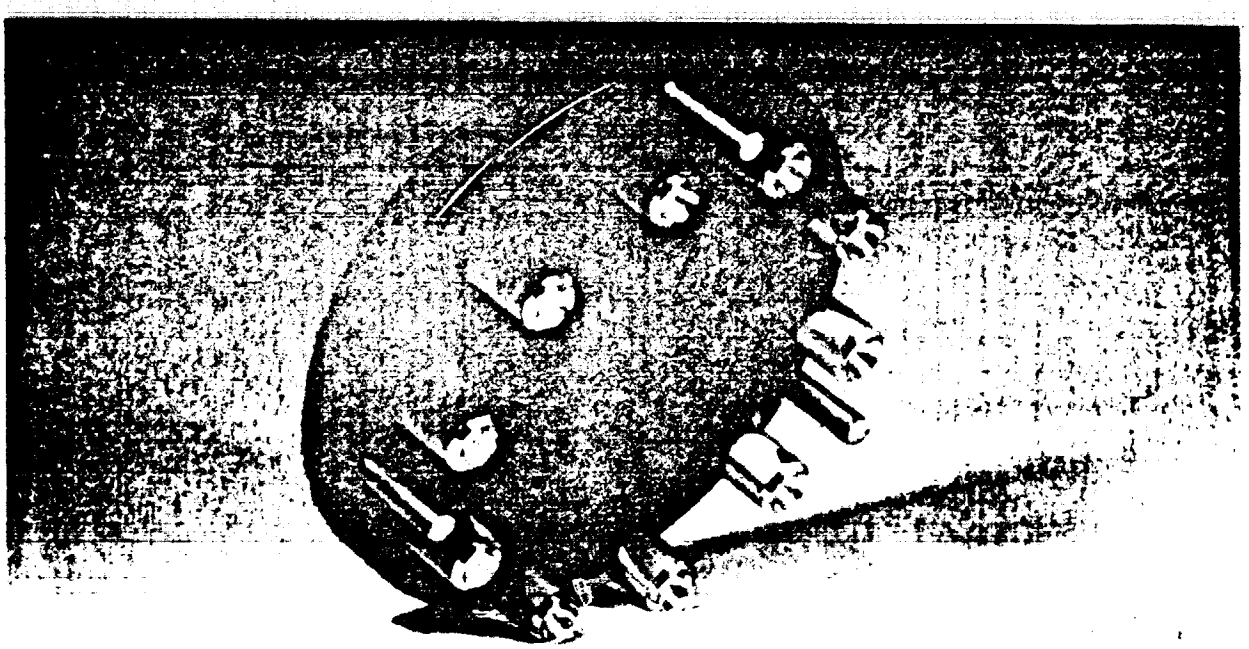


Figure 15.- Portable tripod markers used to define runway test section and coordinate [illegible]



(a) Front view



(b) 3/4 Rear view

Figure 16.- NASA water depth gage.

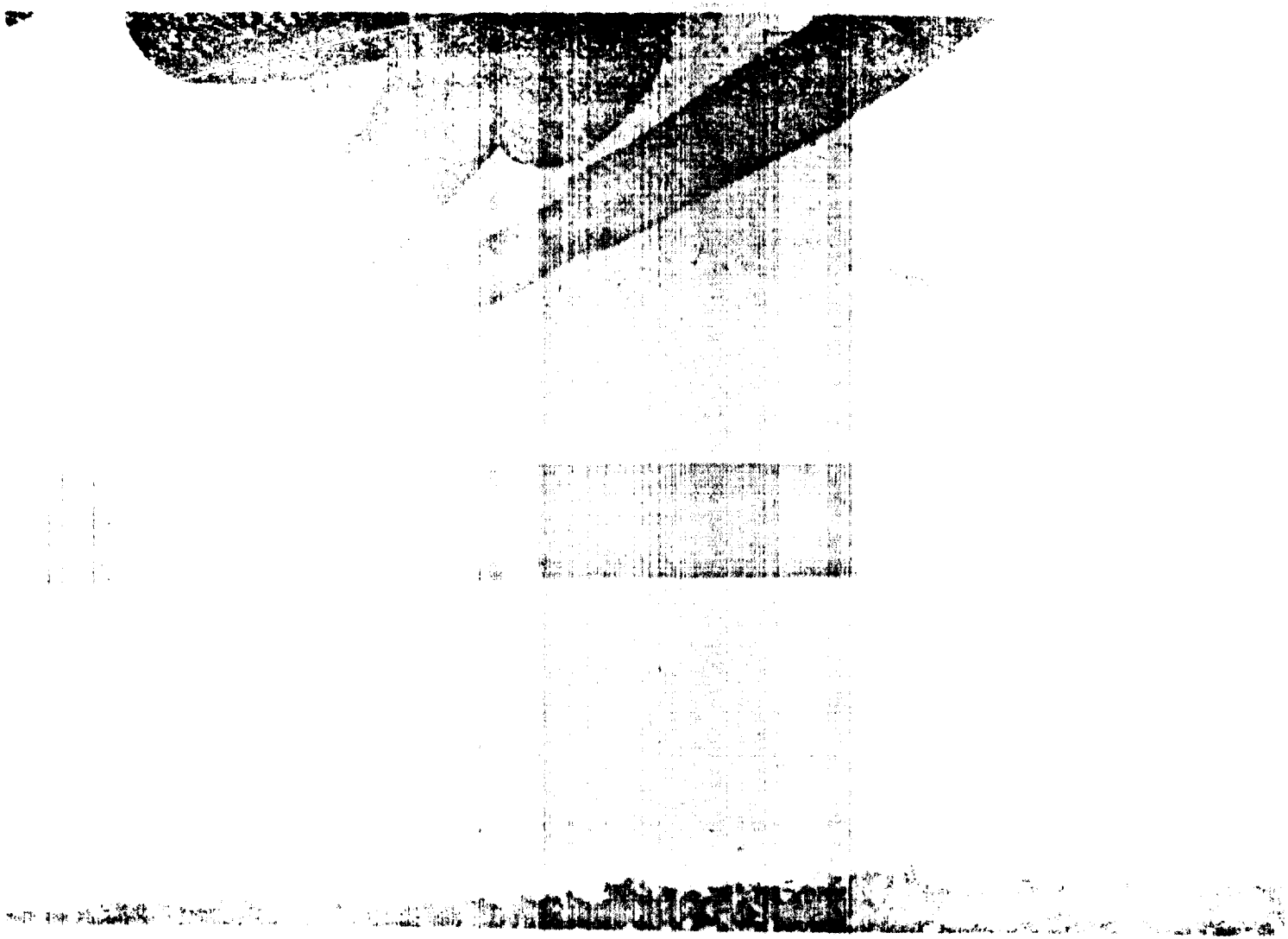
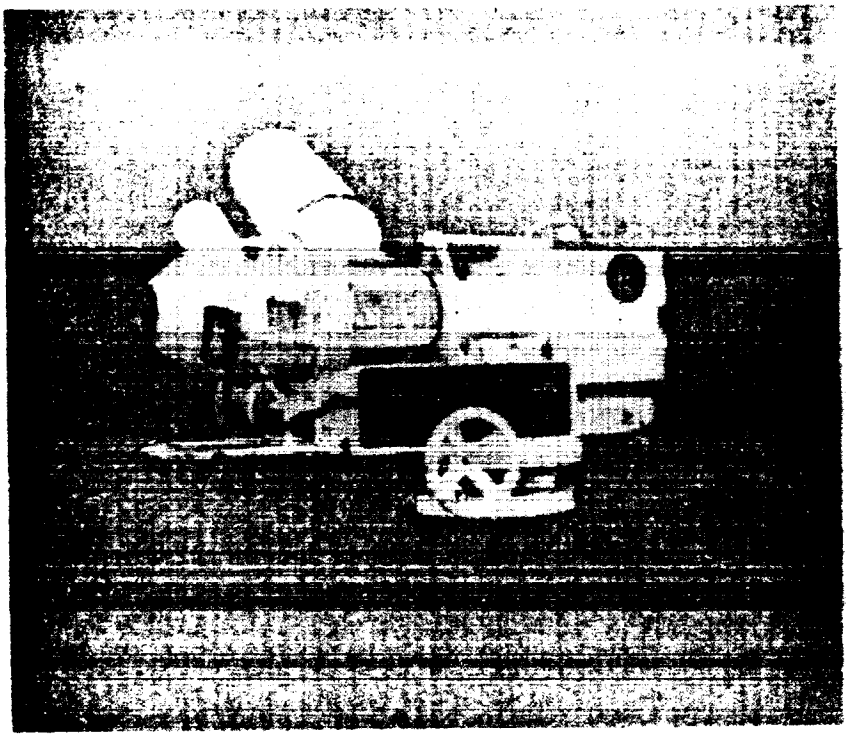
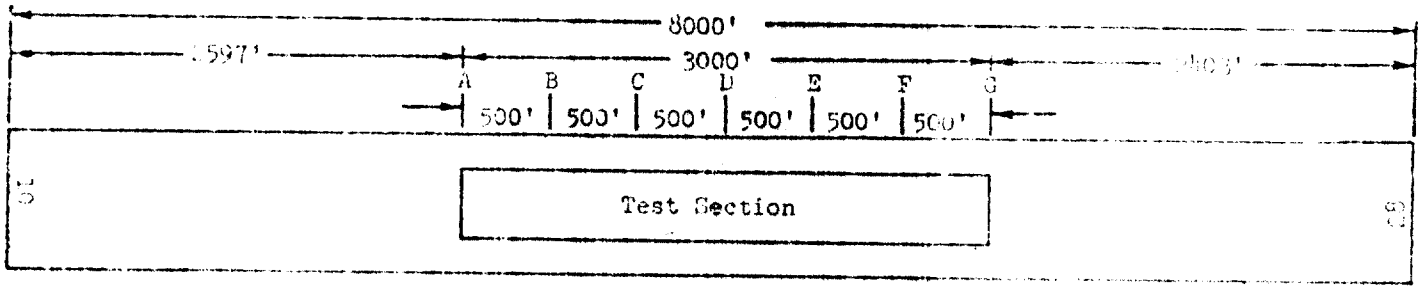
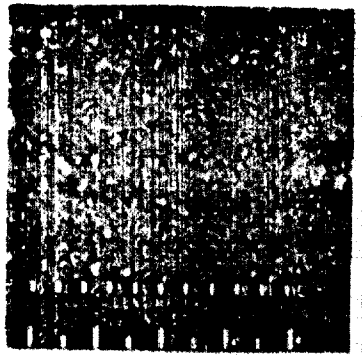


Figure 17.- Runway texture depth measuring kit.



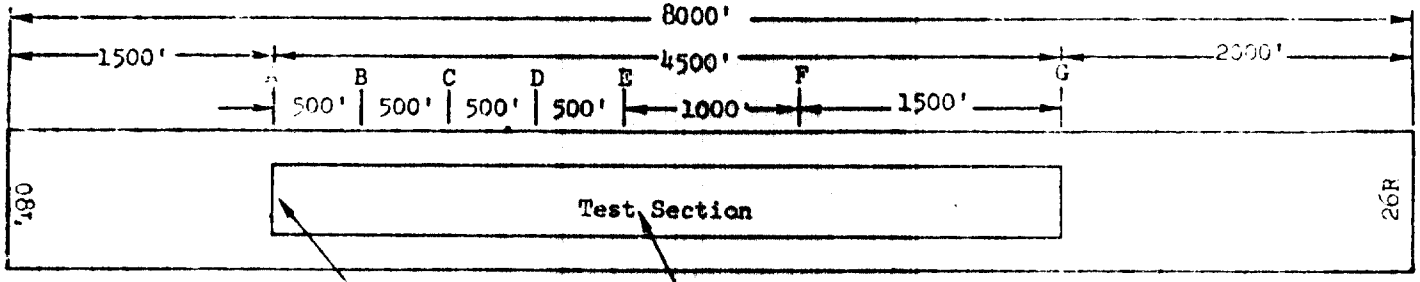




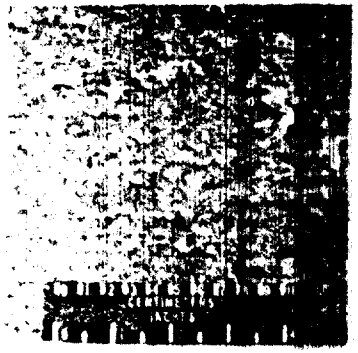
Runway	Test Area
Elevation: 25 ft Width: 200 ft Crown: 1 percent Surface type: Emery seal asphalt Effective gradient: Variable	Rubber contamination: Average texture depth: Effective gradient: 0

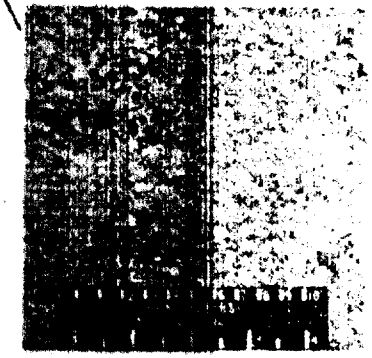
(a) NASA Wallops Station.

Figure 7.- Test runway schematics and surface characteristics.



Note: For aircraft test runs in 260° heading, runway markers reversed with "A" [illegible] "G".

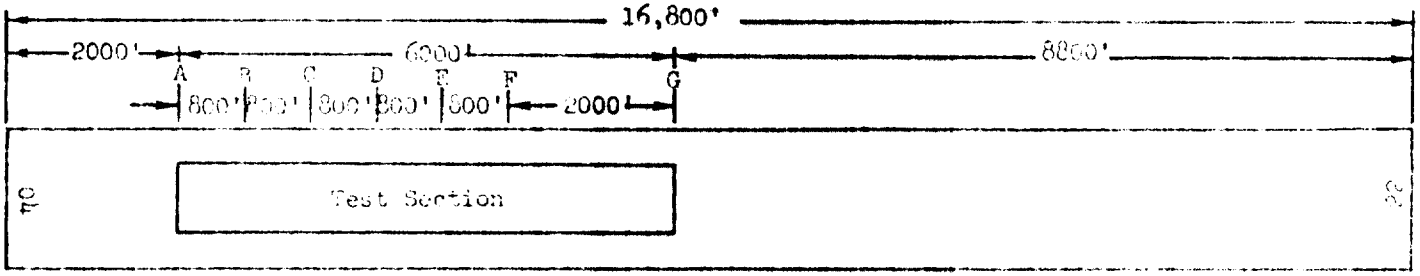




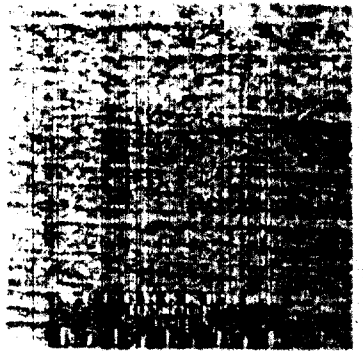
Runway	Test Section
Elevation: [illegible] ft Width: [illegible] ft Crown: [illegible] percent Surface type: Plant mix asphalt Effective gradient: 0	Rubber contamination: [illegible] Average texture depth: [illegible] mm Effective gradient: 0

(b) Lubbock Regional Airport.

Figure 19.- Continued.



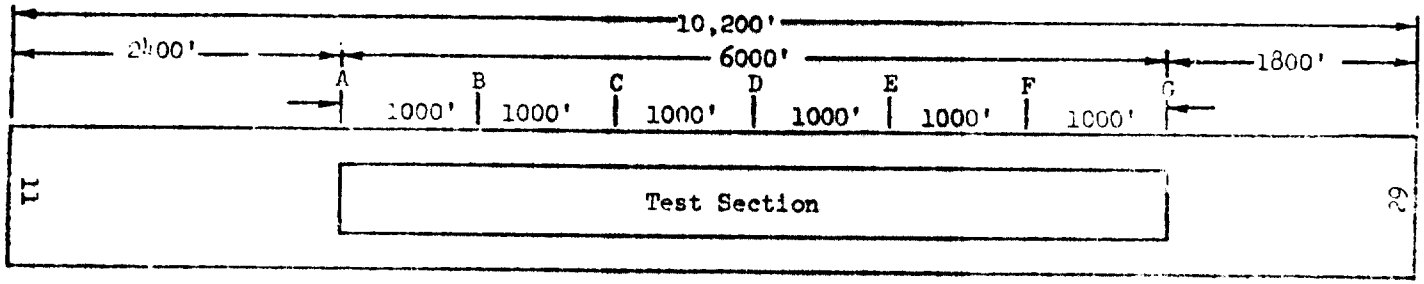
Note: For aircraft test runs in 220° heading, runway markers reversed [illegible]



Runway	Test Surface
Elevation: [illegible] ft	Rubber contamination: [illegible]
Width: 300 ft	Average texture depth: [illegible] mm
Crown: [illegible] percent	Effective gradient: [illegible] percent in 040° heading
Surface type: [illegible] 220°	[illegible] percent in 220° heading
Effective gradient: 0.240 percent	

(c) Edwards Air Force Base

Figure 10.- Continued.



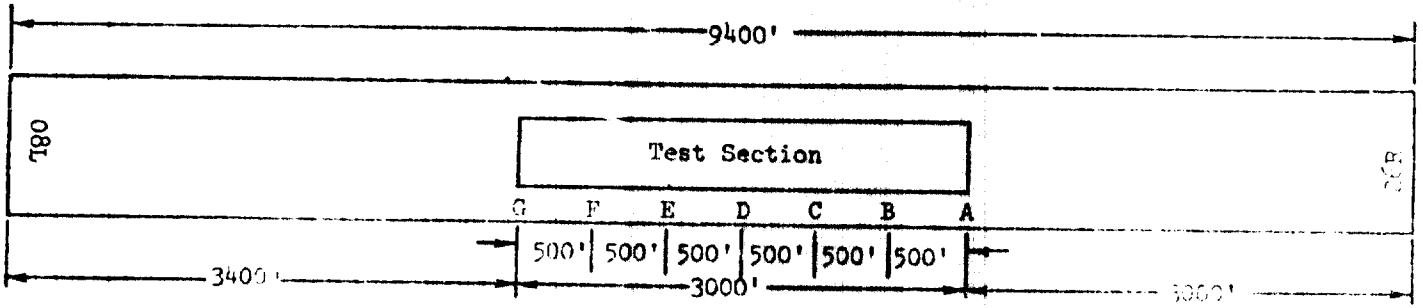
Note: Runway markers were not changed for aircraft test runs in 290° heading.

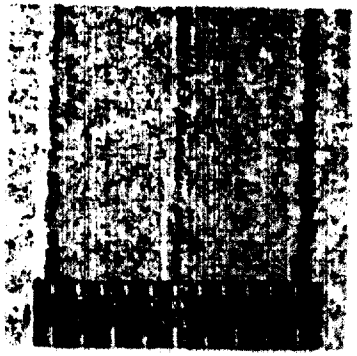


[illegible] West	Test Section
Elevation: [illegible] ft	Rubber contamination: [illegible]
Width: [illegible] ft	Average texture depth: [illegible]
Crown: [illegible] percent	Effective gradient: +0.47 percent in 110° heading
Surface type: PCC	-0.47 percent in 290° heading
Effective gradient: 0.47 percent	

(d) Edmonton International Airport

Figure 10.- Continued.





Runway	Test section
Elevation: 98 ft Width: 150 ft Crown: 1 percent Surface type: Transversely grooved canvas-belt finished PCC Groove pattern: 2" x 1/4" wide x 1/4" deep Effective gradient: 0.38% percent	Rubber contamination: Heavy film Average texture depth: -- Effective gradient: +0.06 percent

[illegible] Intercontinental Airport.

[illegible] 19.- Continued.

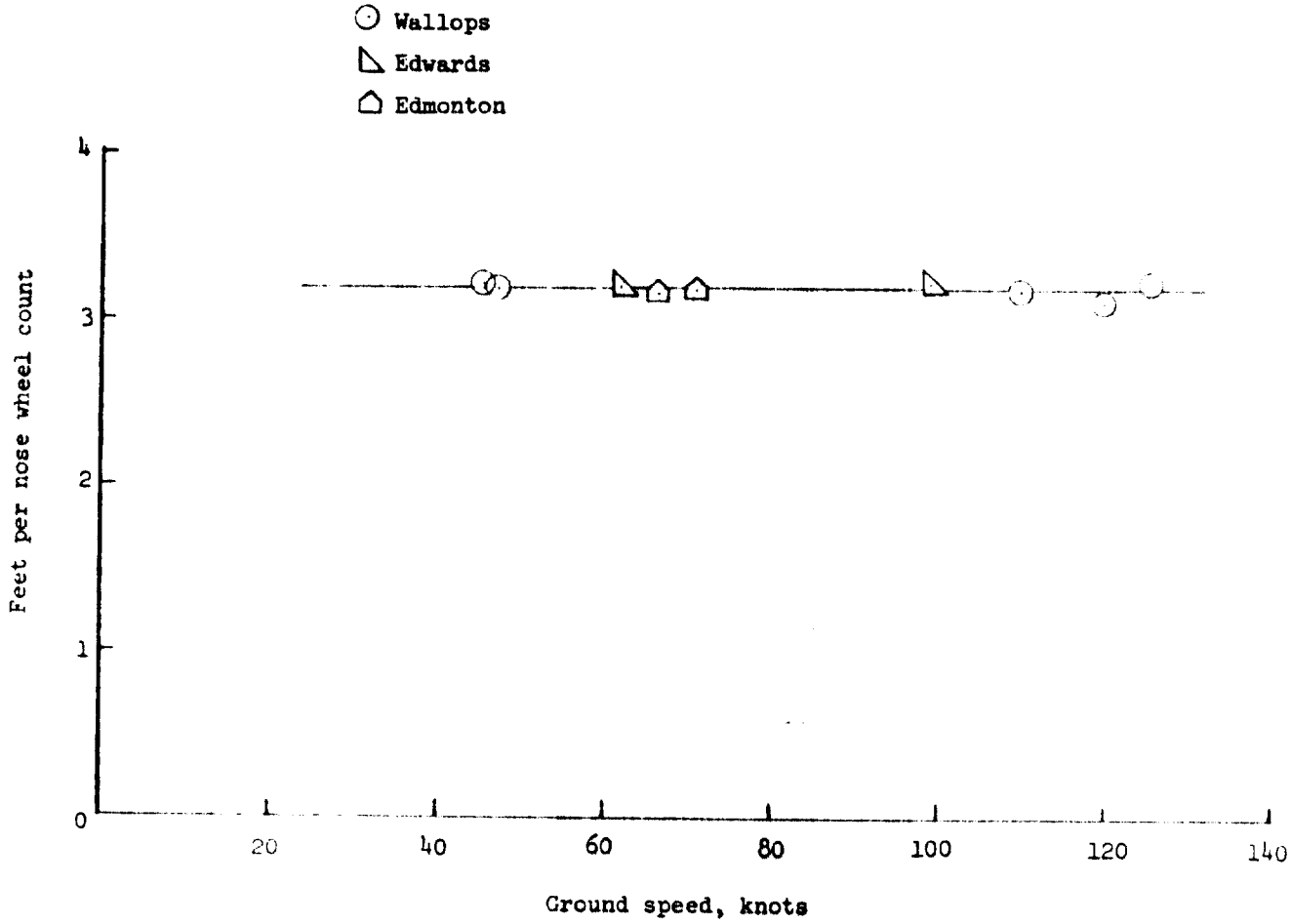
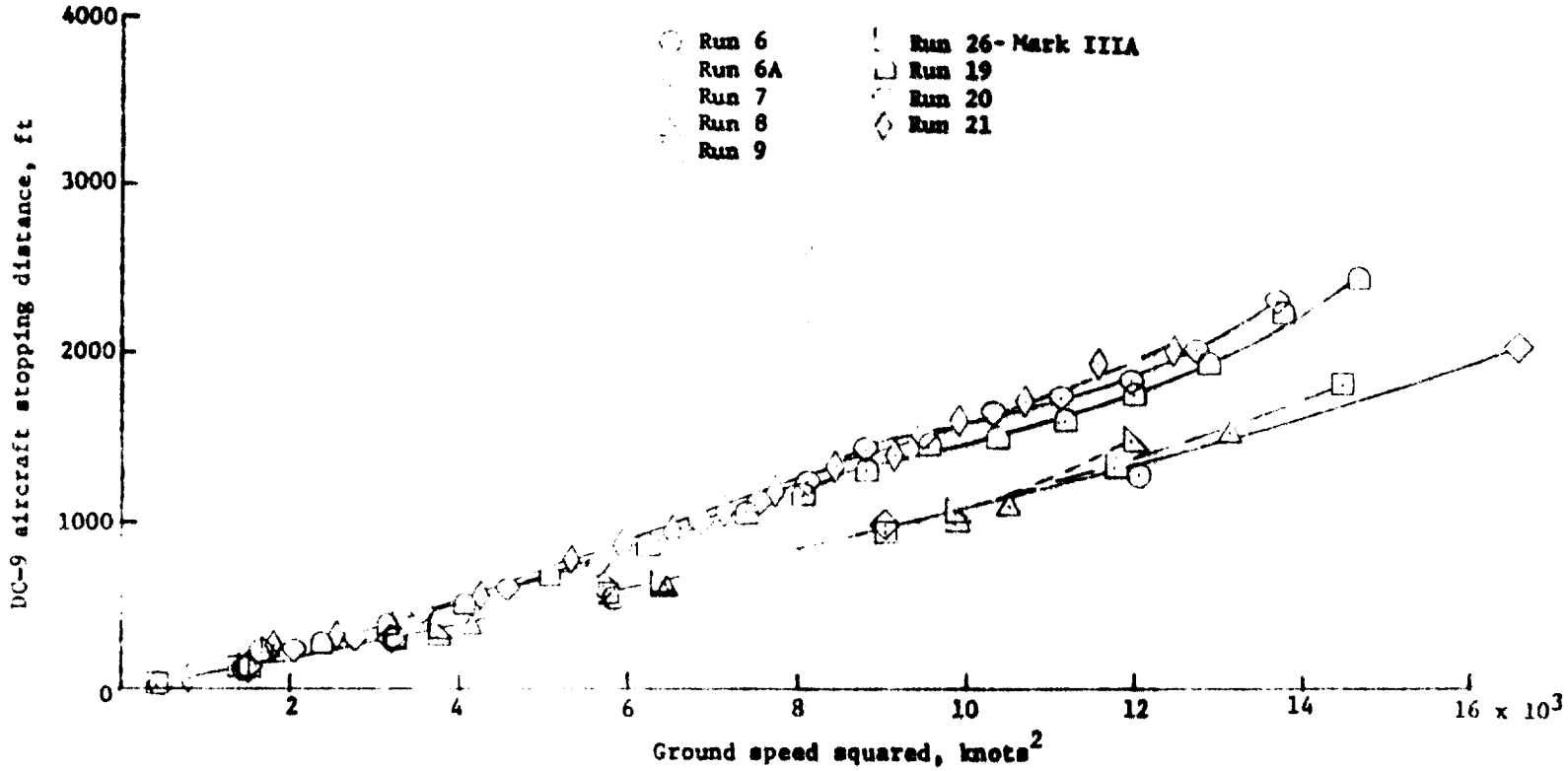
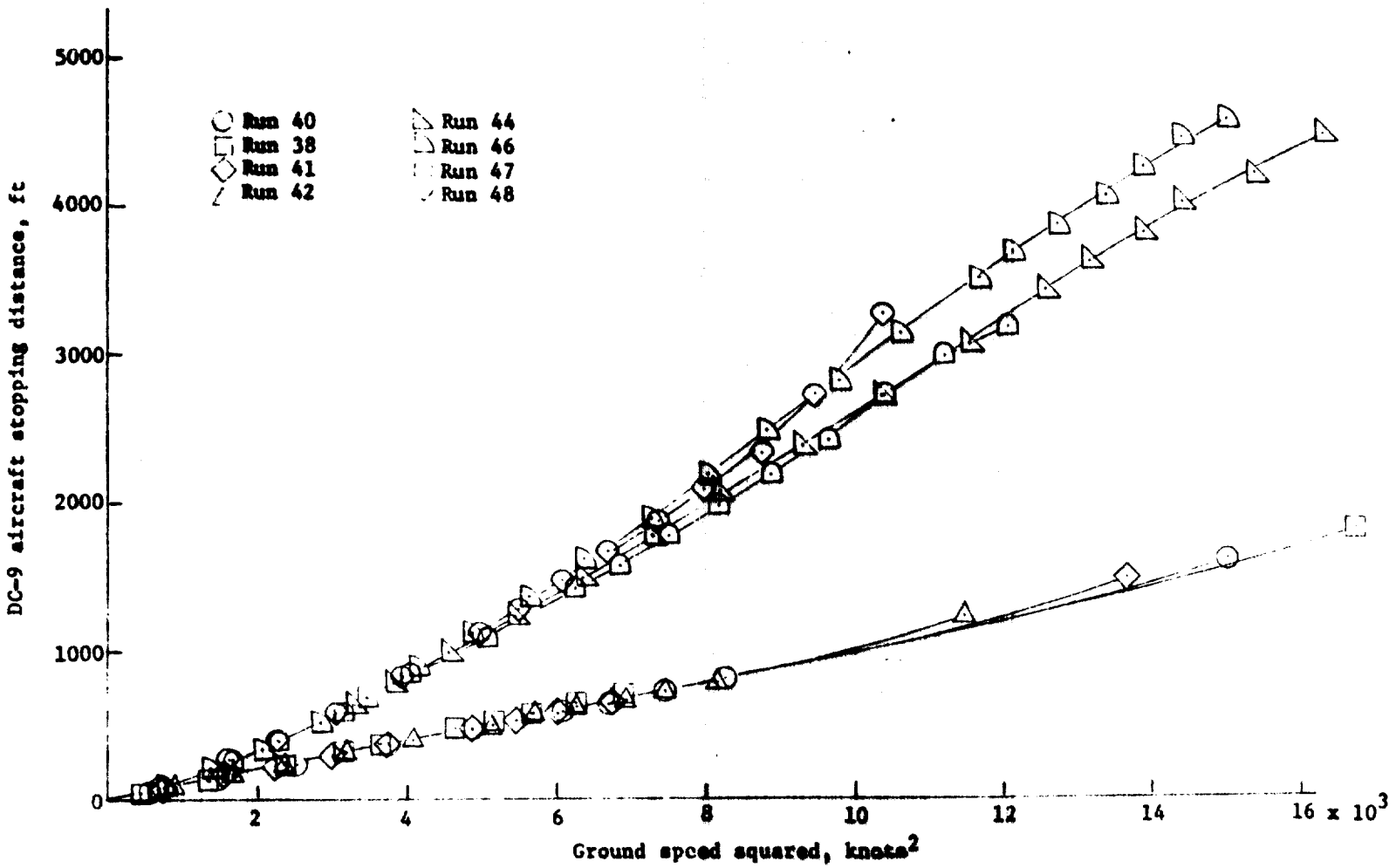


Figure 20.- NASA nose wheel distance counter calibration.



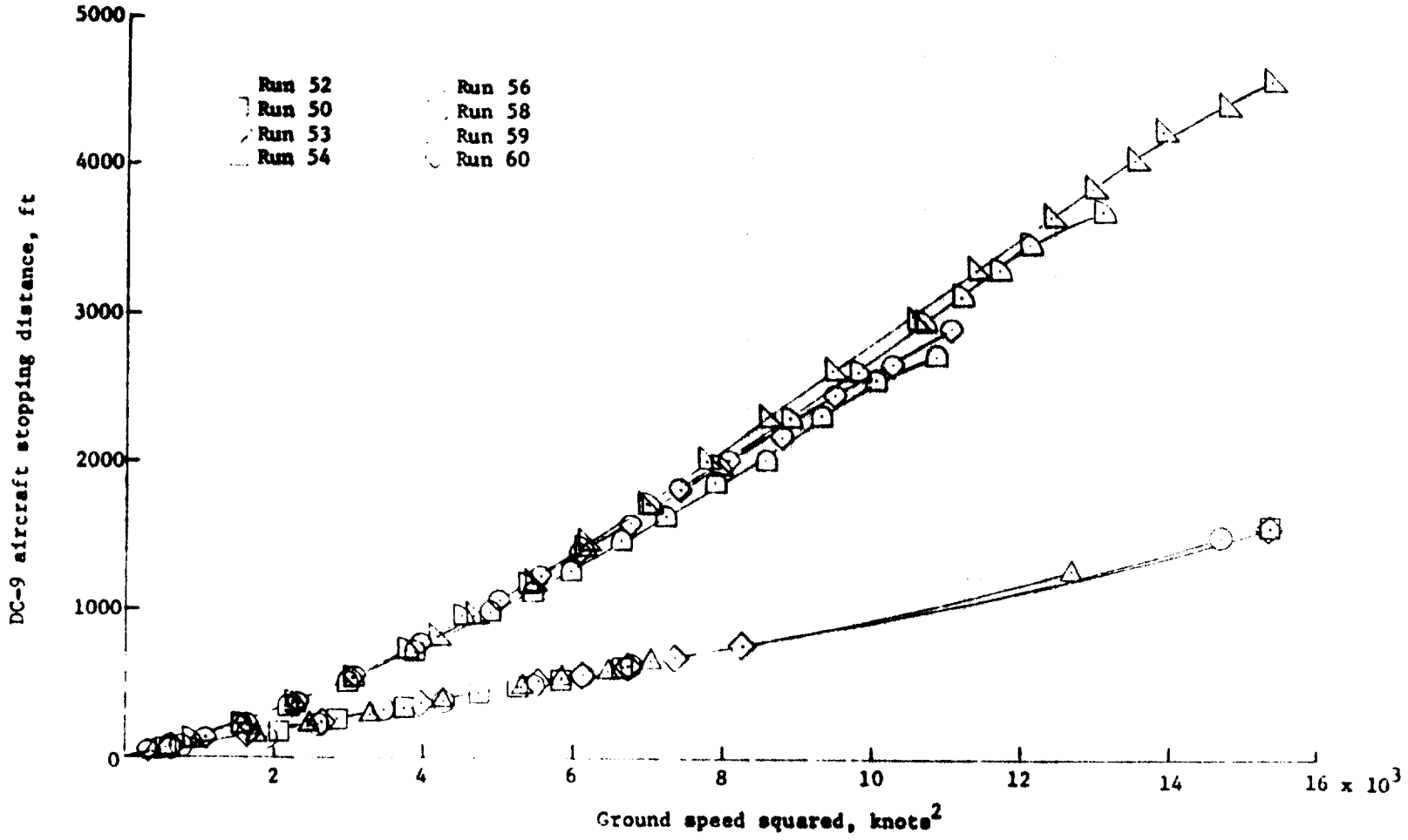
(a) NASA Wallops Station, MARK II and Mark IIIA anti-skid systems.

Figure 21.- Variation of DC-9 aircraft stopping distance as a function of ground speed squared.



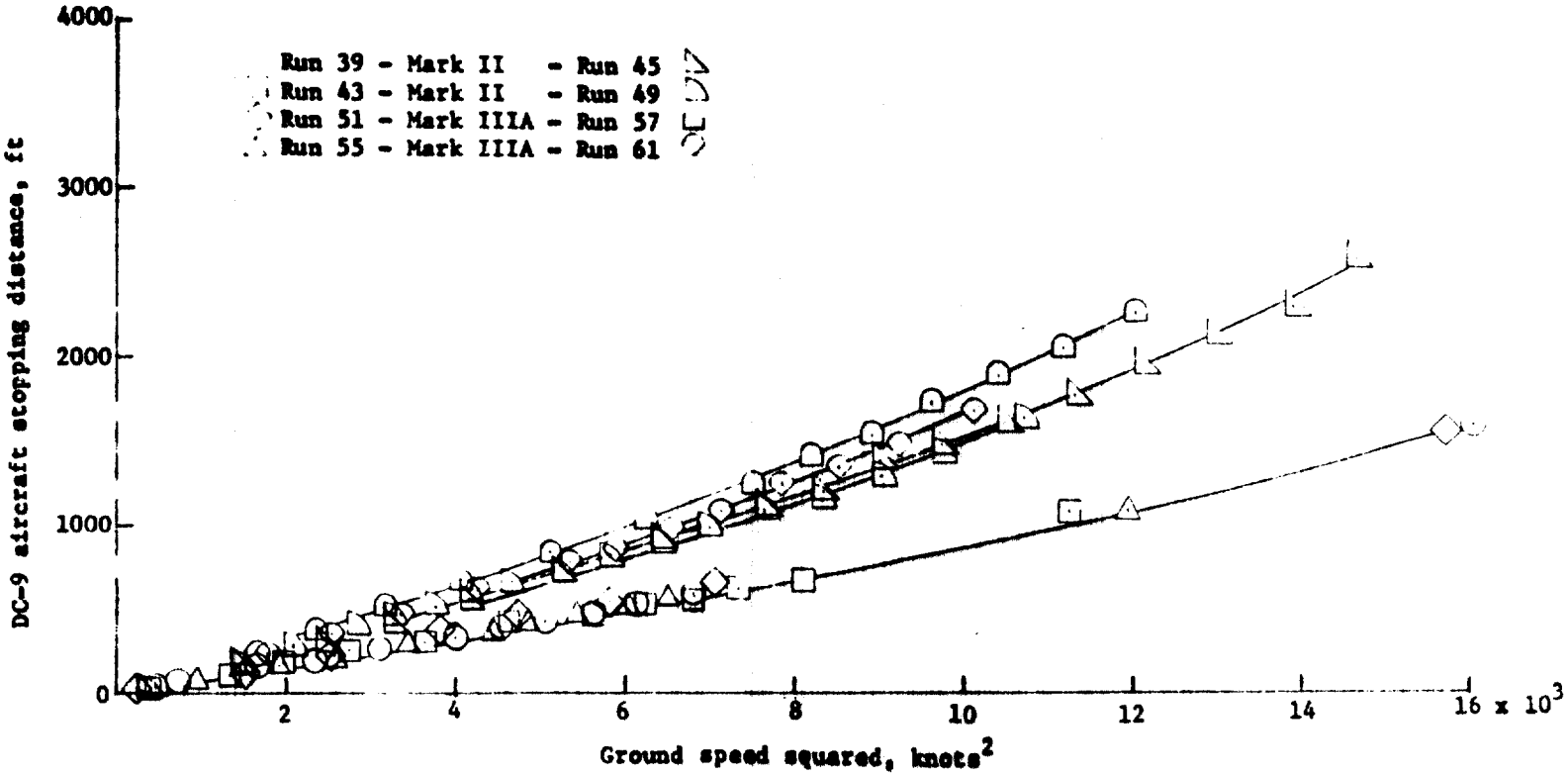
(b) Lubbock, Mark II anti-skid system.

Figure 21.- Continued.



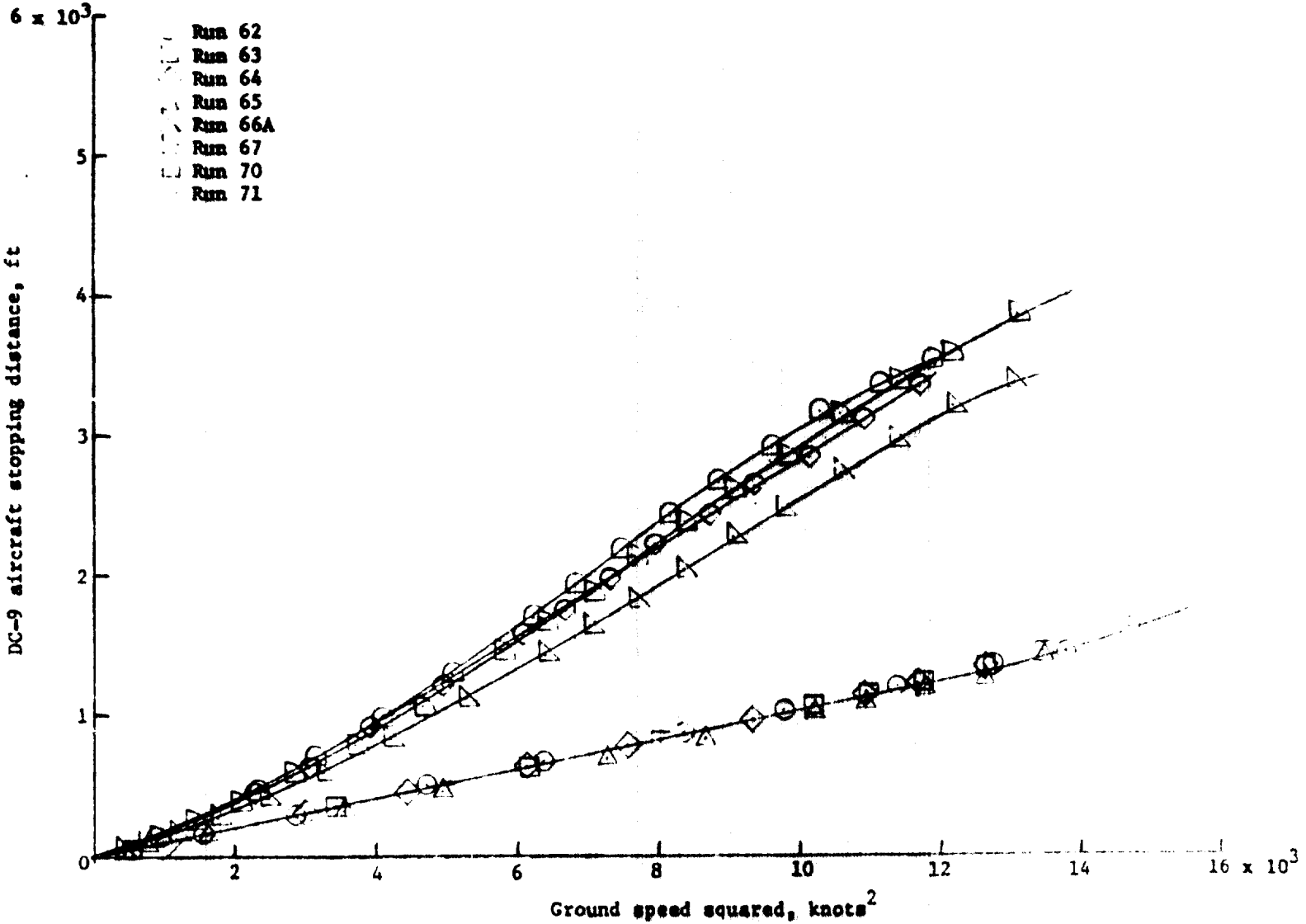
(c) Lubbock, Mark IIIA anti-skid system.

Figure 21.- Continued.



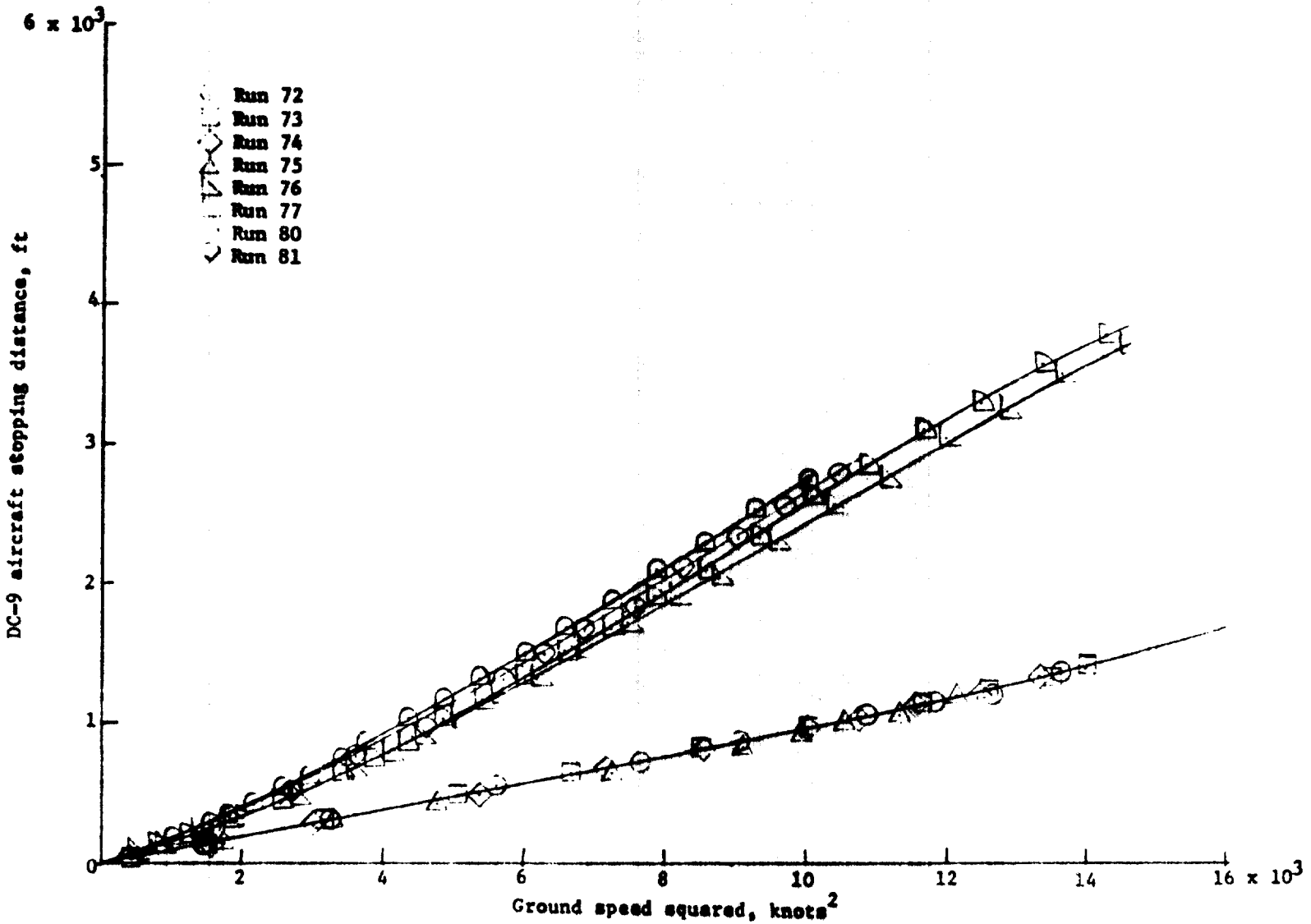
(d) Lubbock, reverse thrust plus maximum braking.

Figure 21.- Continued.



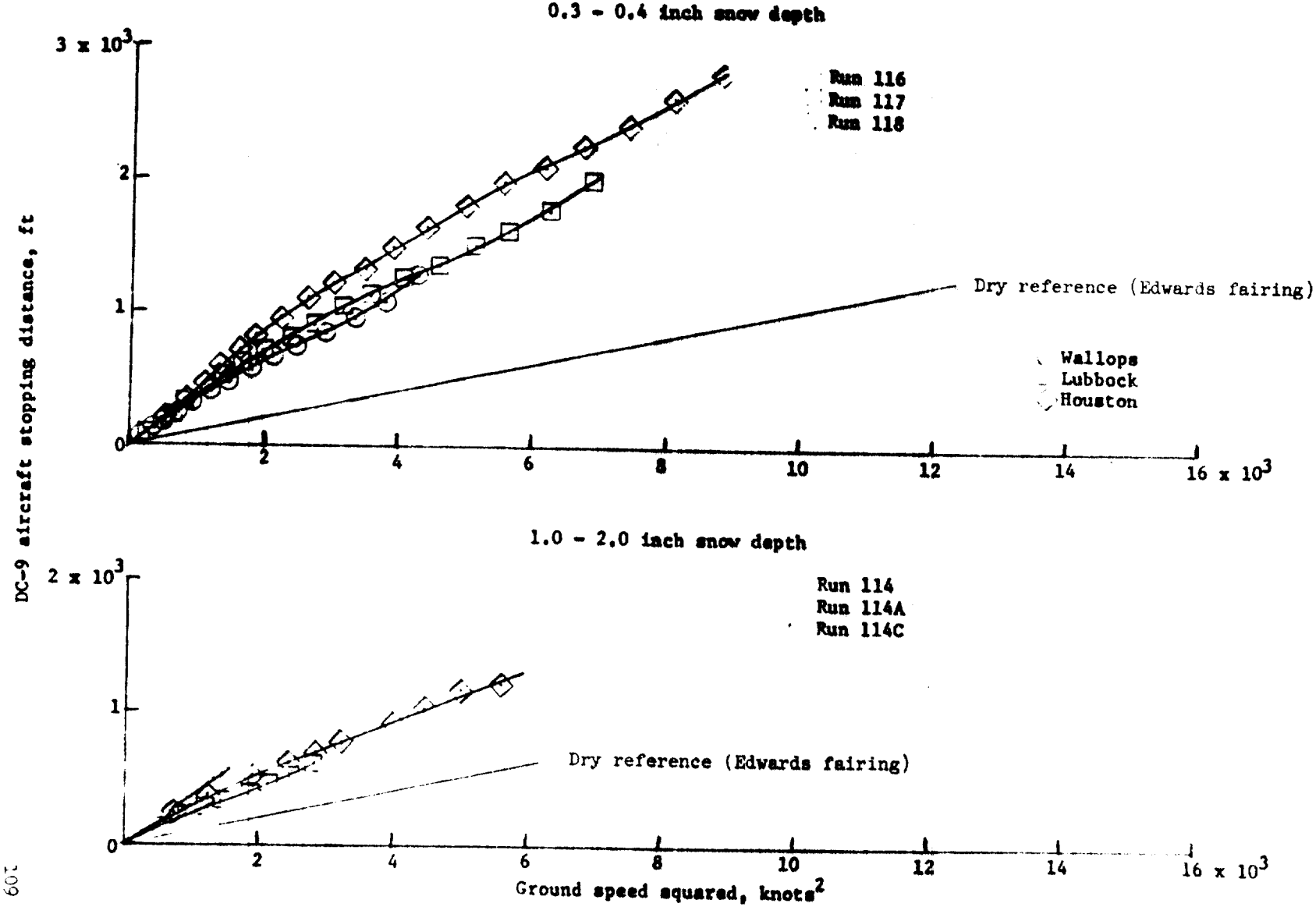
(e) Edwards, Mark II anti-skid system.

Figure 21.- Continued.



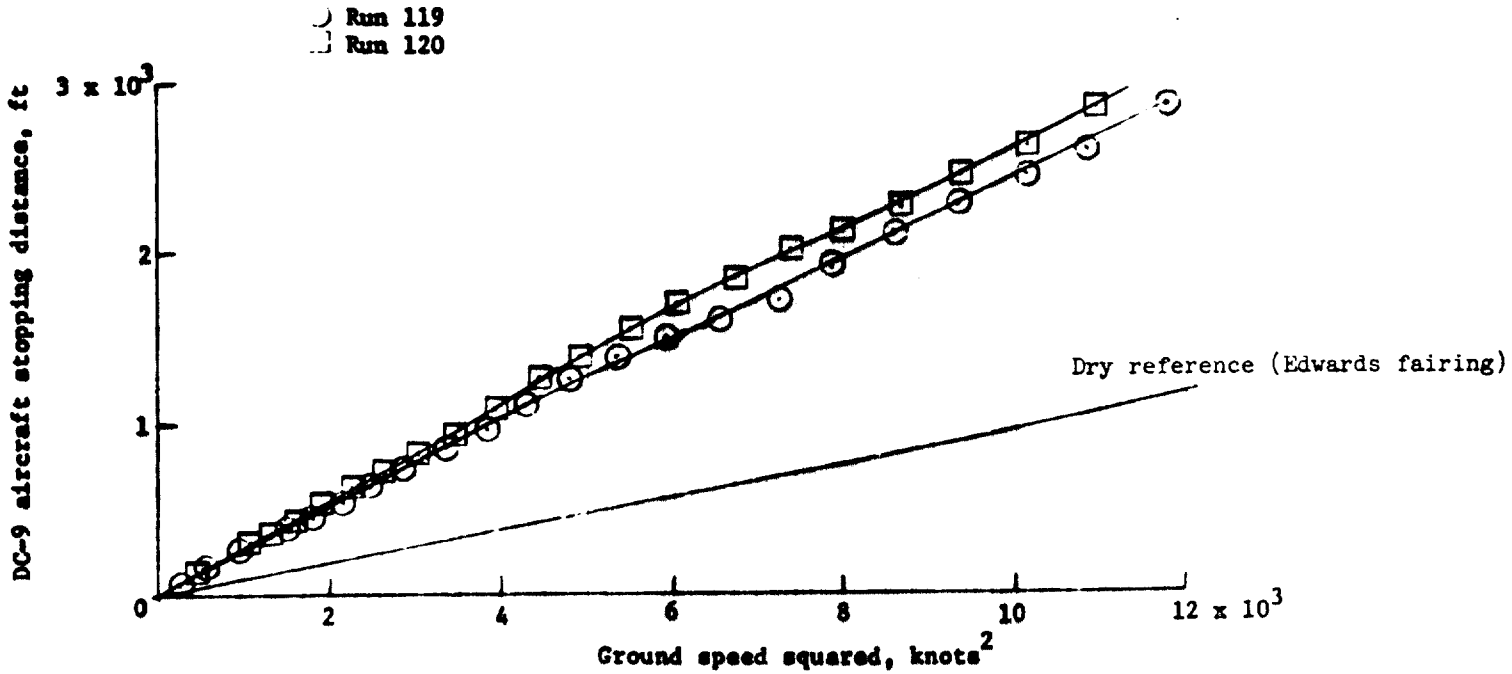
(f) Edwards, Mark IIIA anti-skid system.

Figure 21.- Continued.



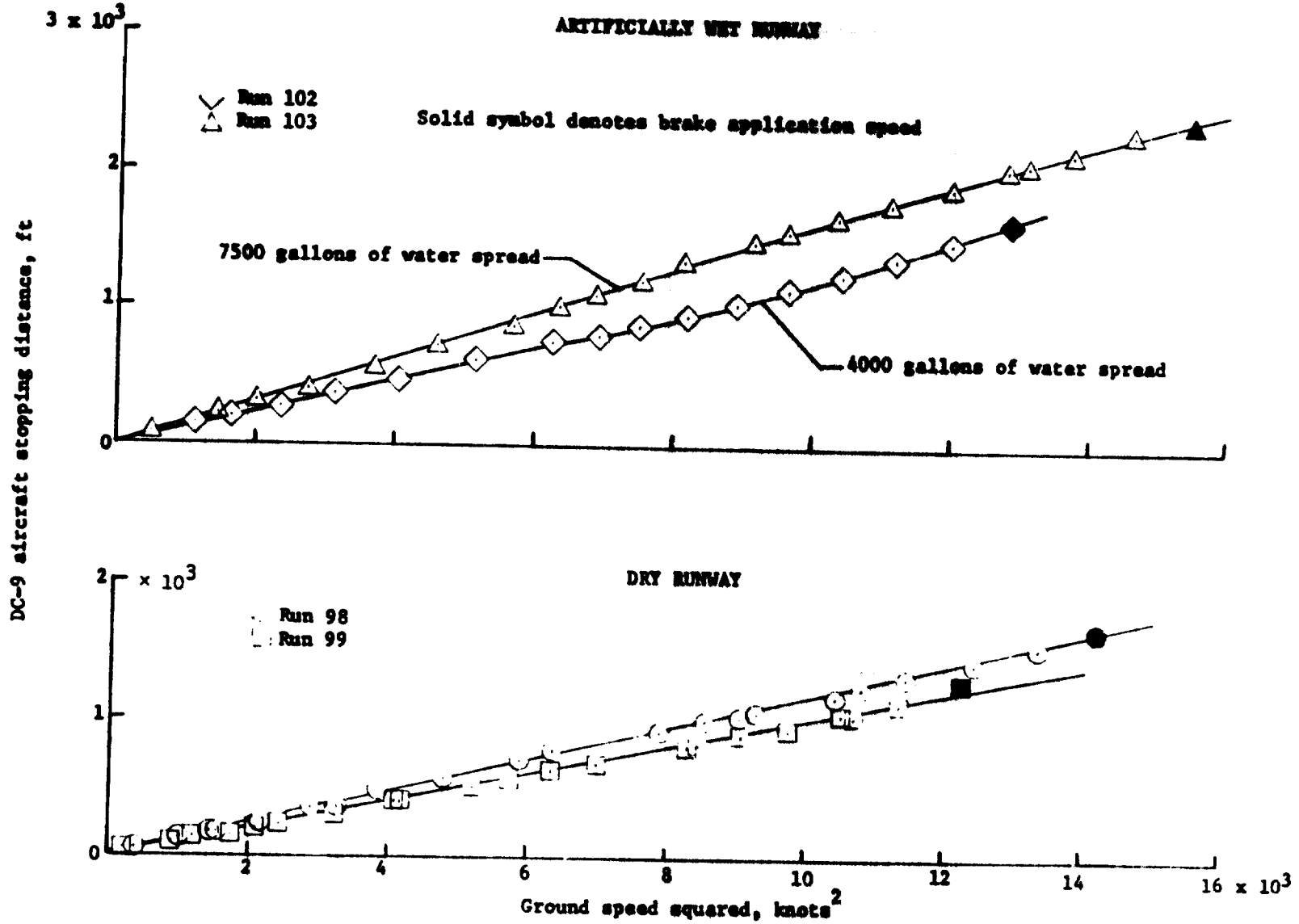
(g) Edmonton, Mark II anti-skid system

Figure 21.- Continued.



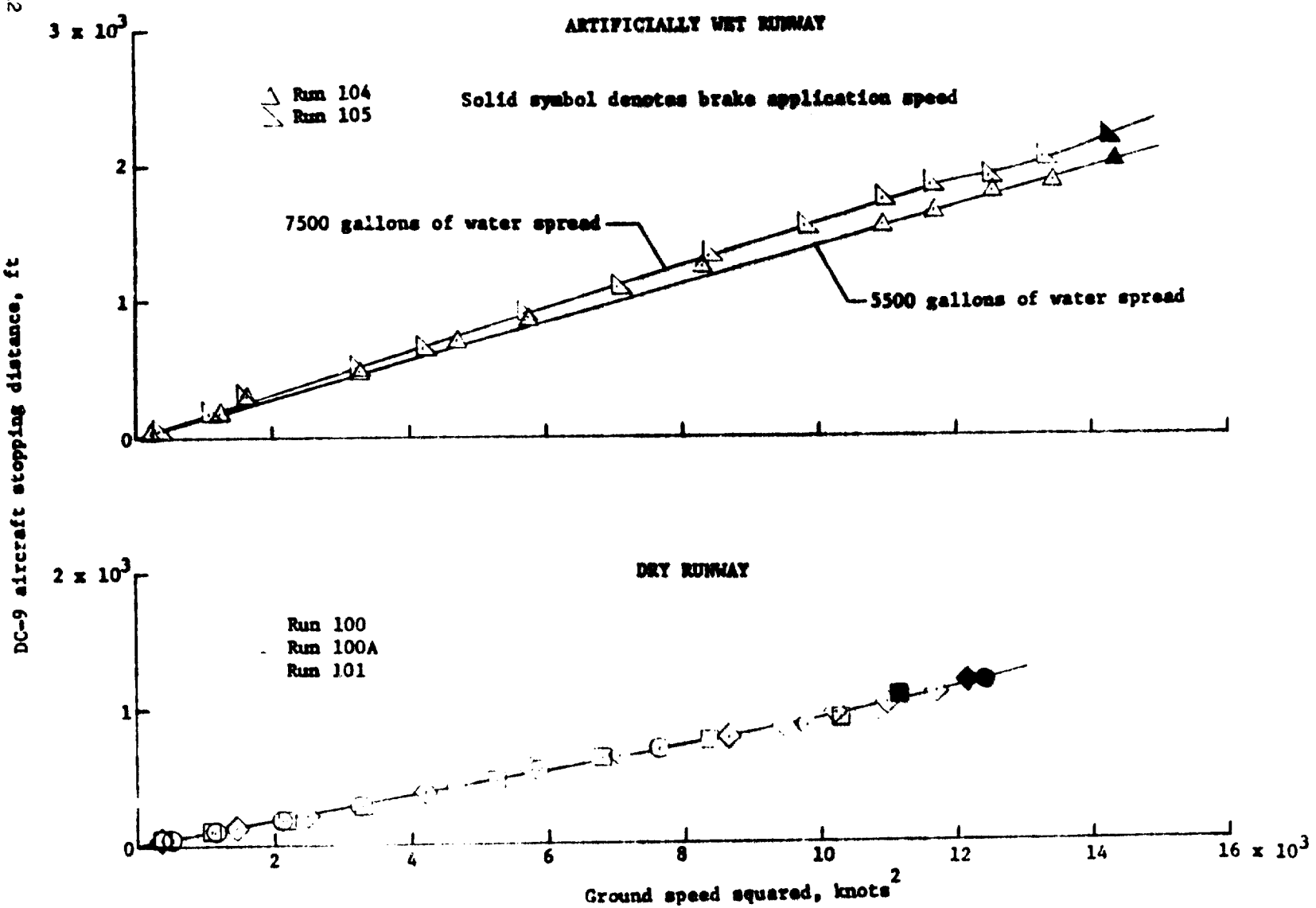
(h) Edmonton, Mark IIIA anti-skid system.

Figure 21.- Continued.



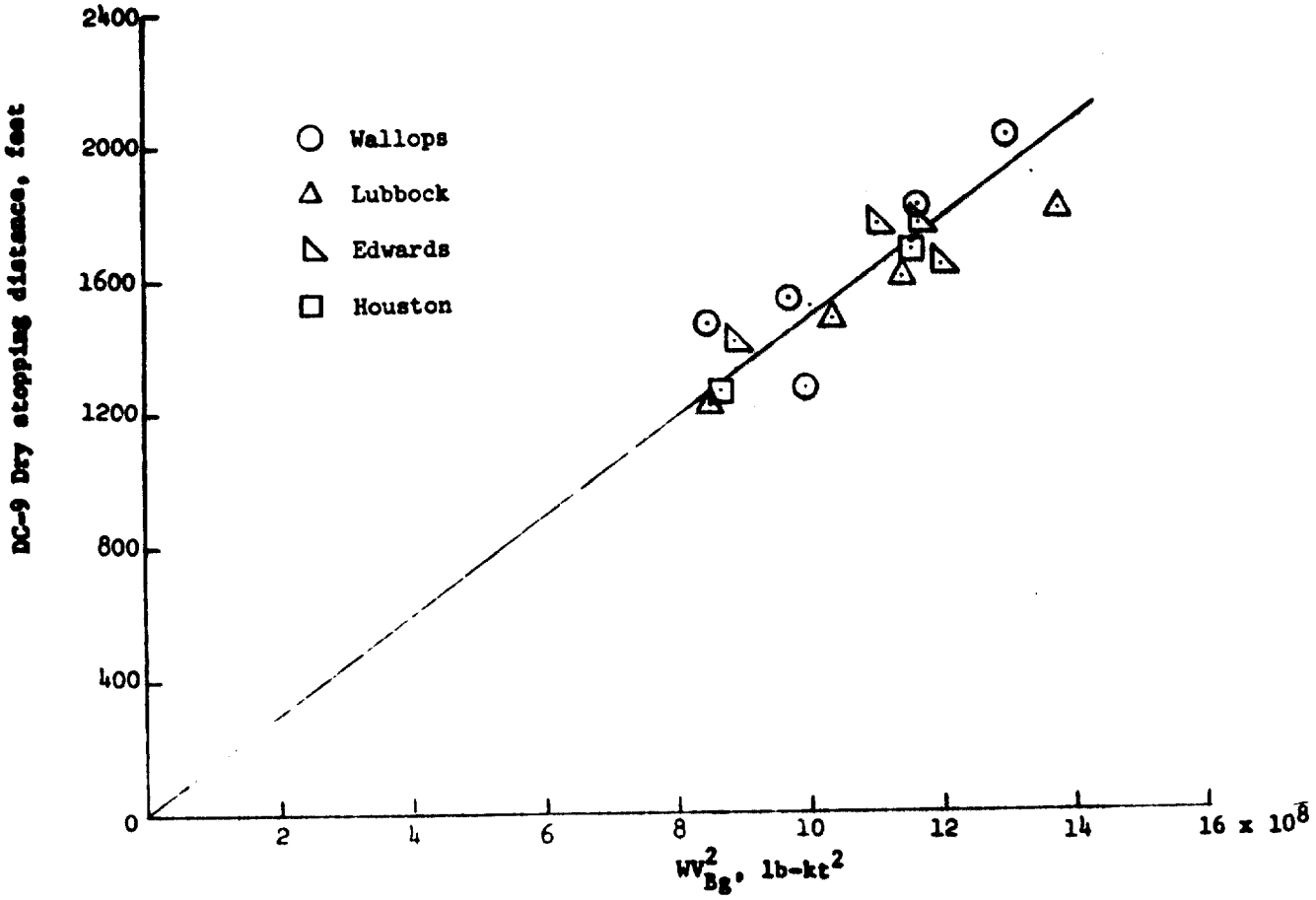
(i) Houston, Mark II anti-skid

Figure 21.- Continued.



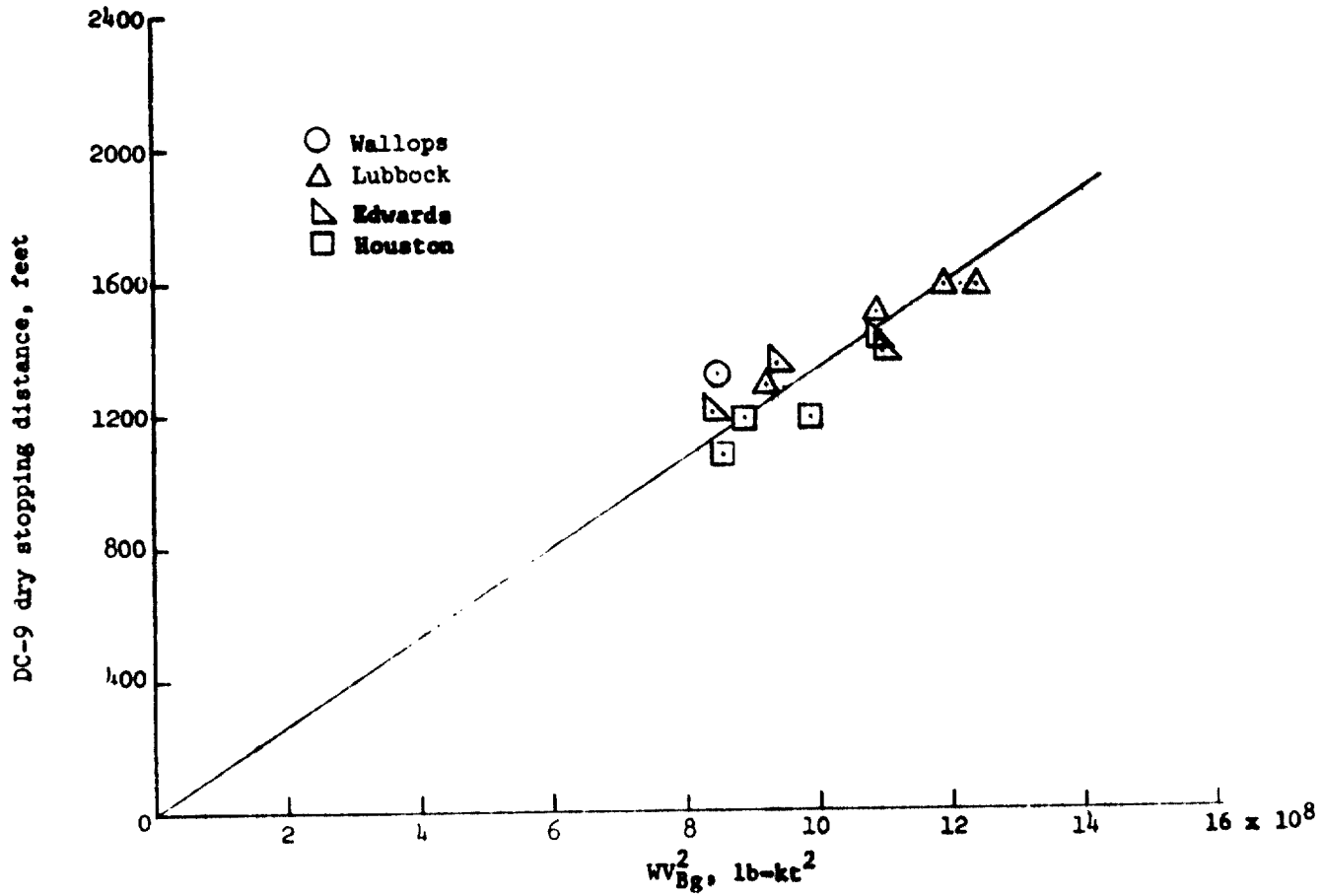
(j) Houston, Mark IIIA anti-skid system.

Figure 21.- Concluded.



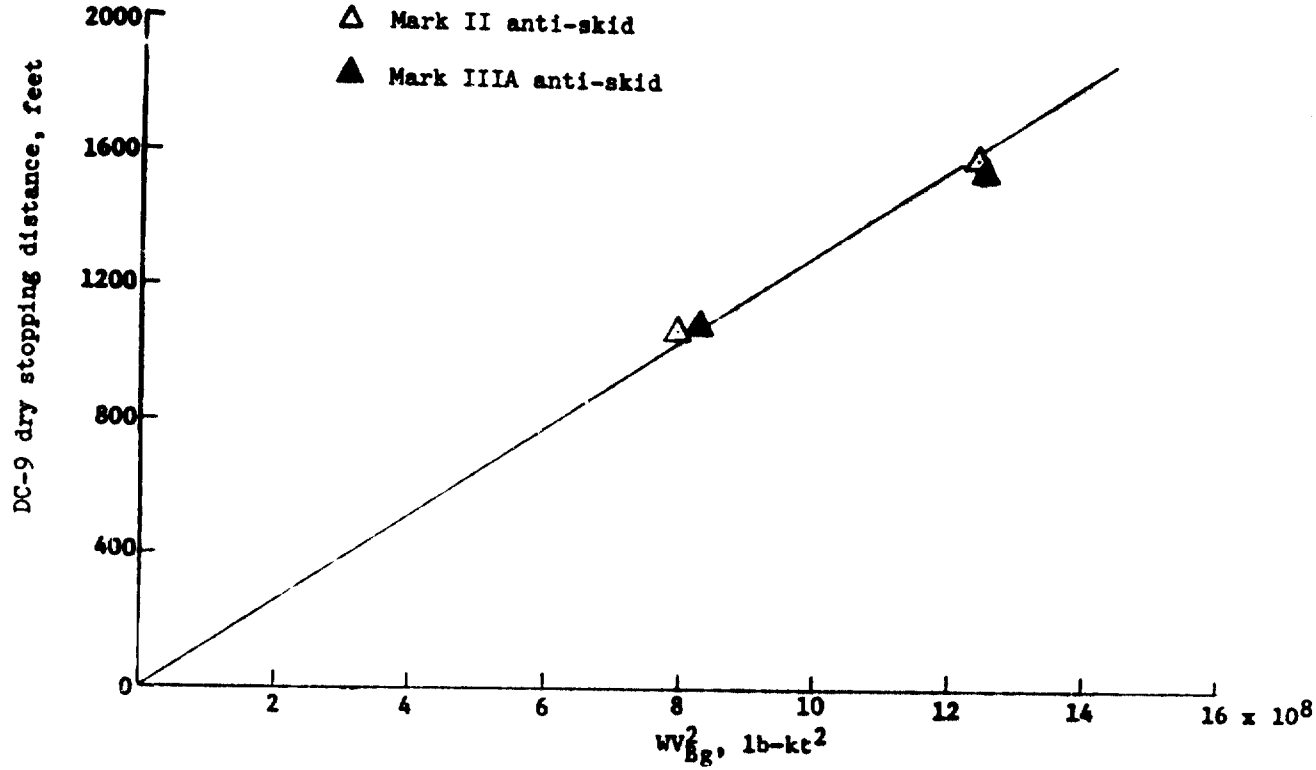
(a) Mark II anti-skid system. NASA data

Figure 22.- Variation of dry stopping distance with aircraft energy at brake application speed.



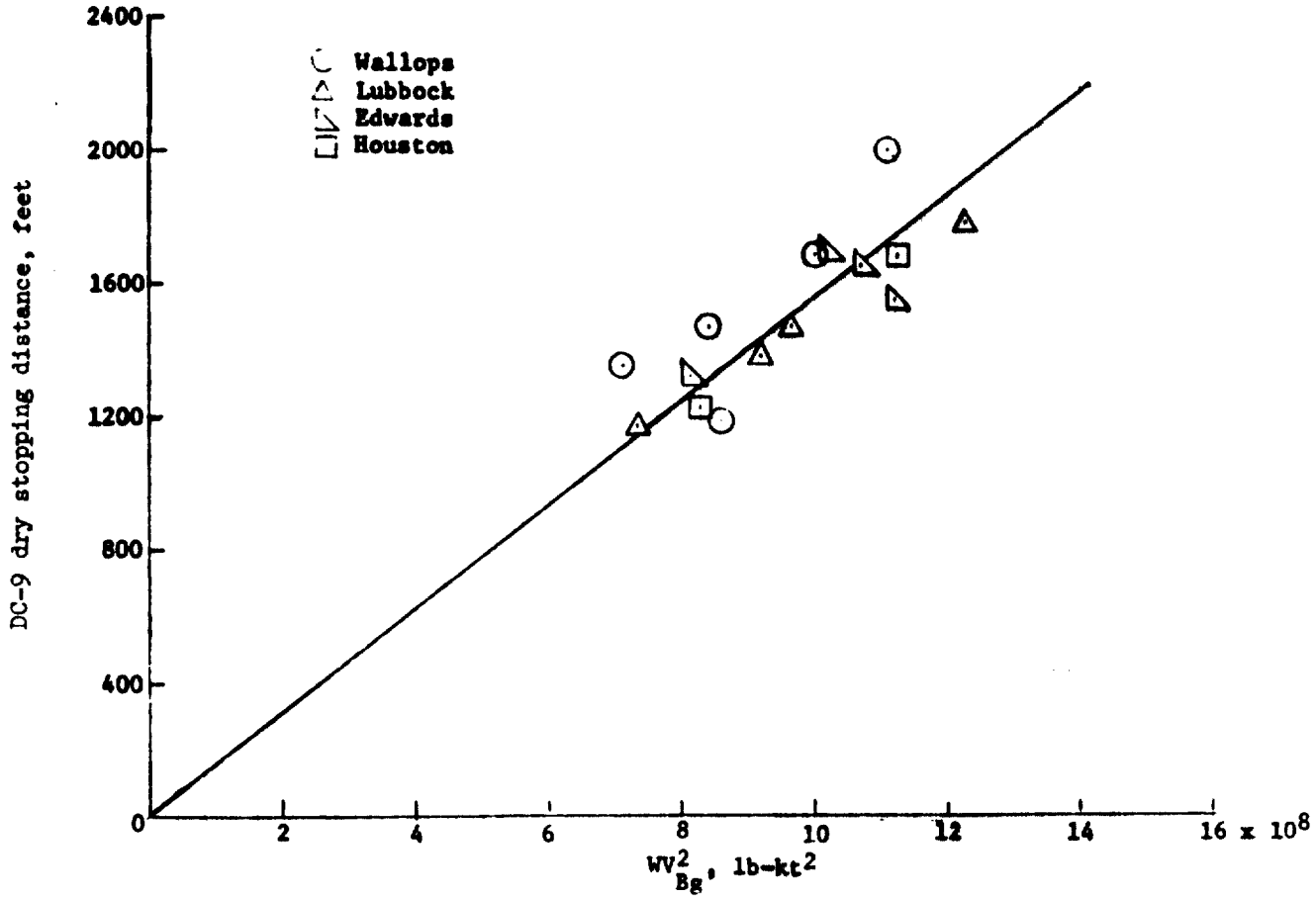
(b) Mark IIIA anti-skid system. NASA data

Figure 22.- Continued.



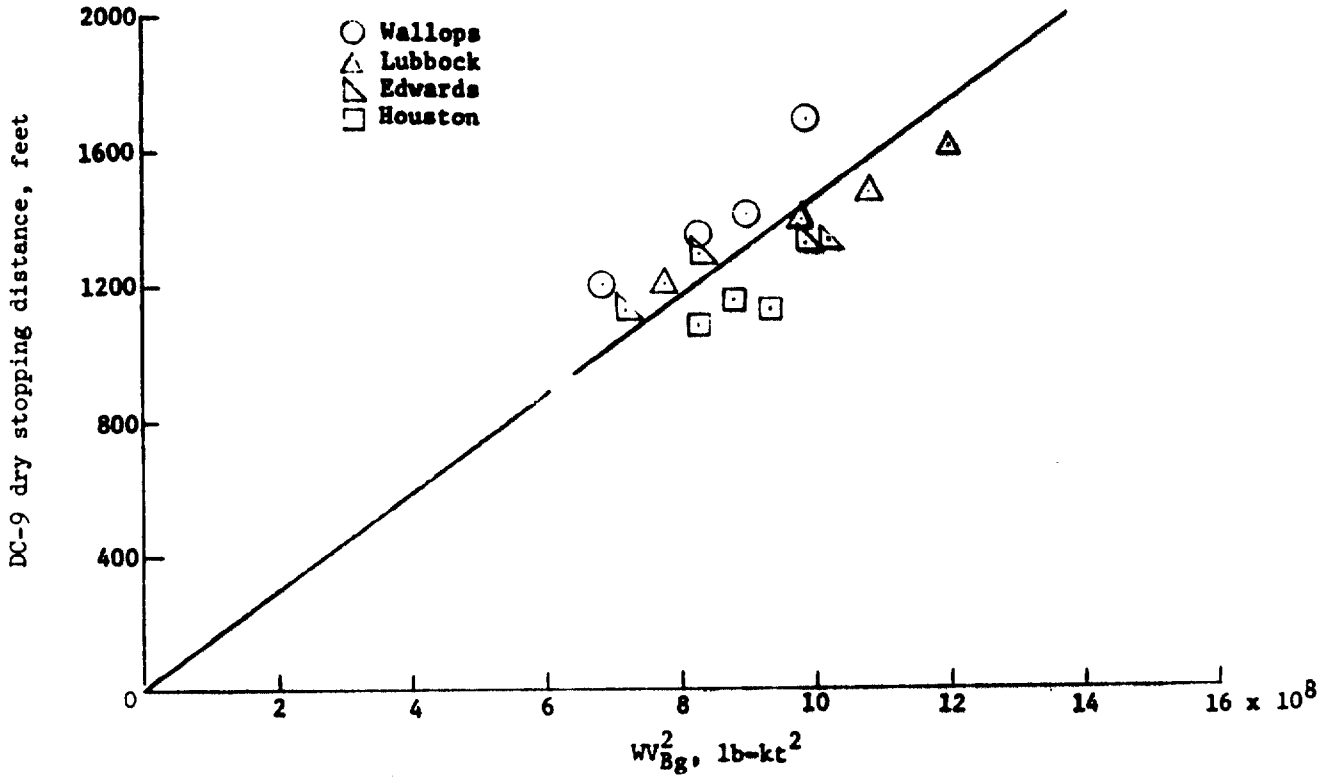
(c) Variation of dry distance to stop using reverse thrust plus maximum brakes. NASA data.

Figure 22.- Continued.



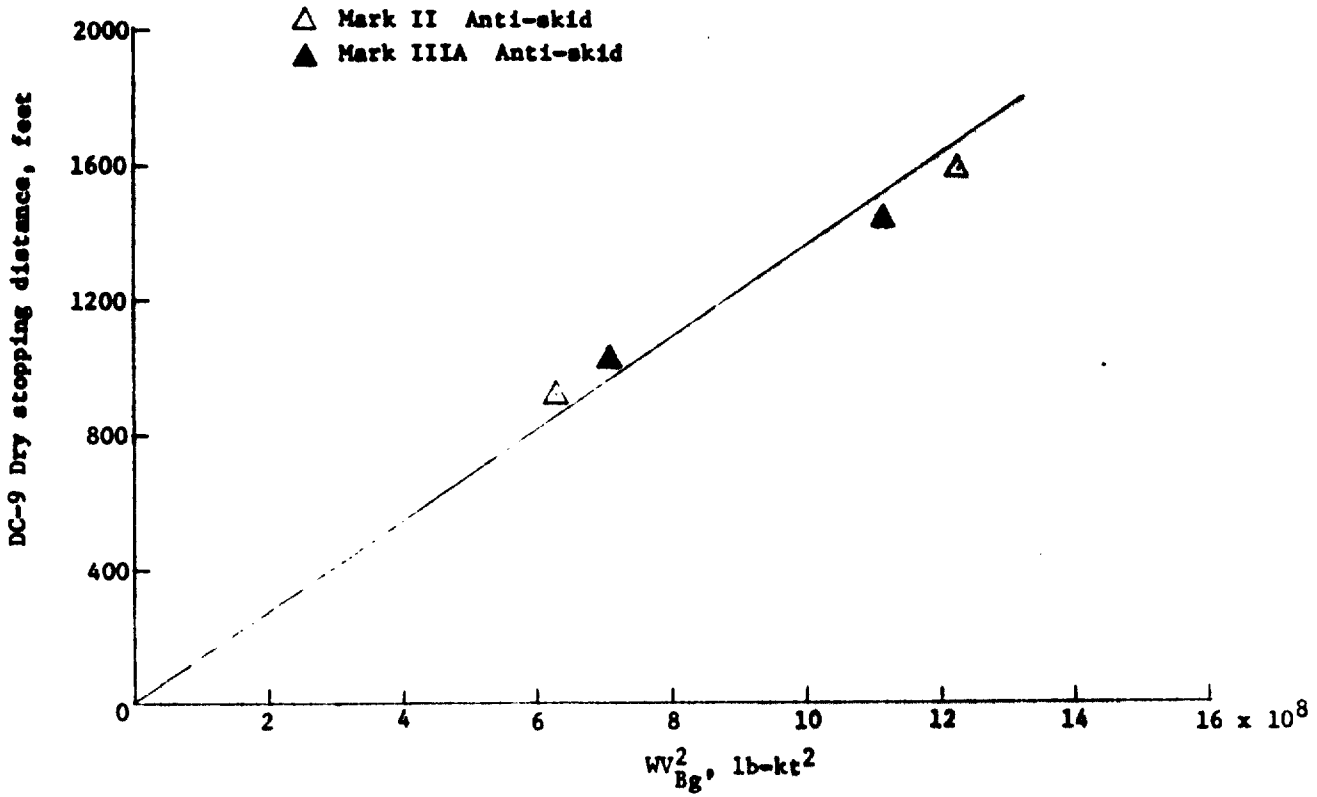
(d) Mark II anti-skid system. Douglas data.

Figure 22.- Continued.



(e) Mark IIIA anti-skid system. Douglas data.

Figure 22.- Continued.



(f) Variation of dry distance to stop using reverse thrust plus maximum brakes. Douglas data.

Figure 22.- Concluded.

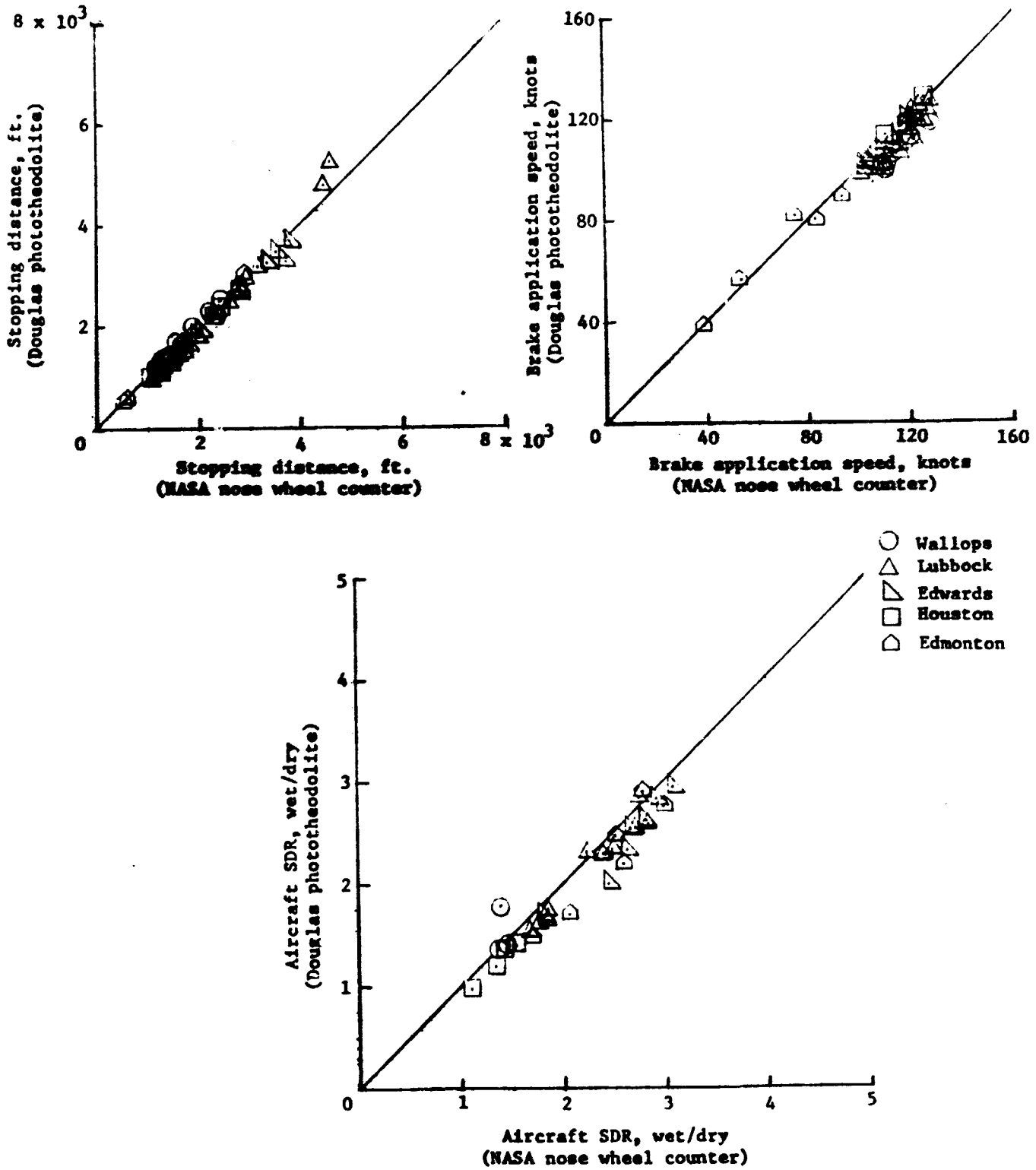
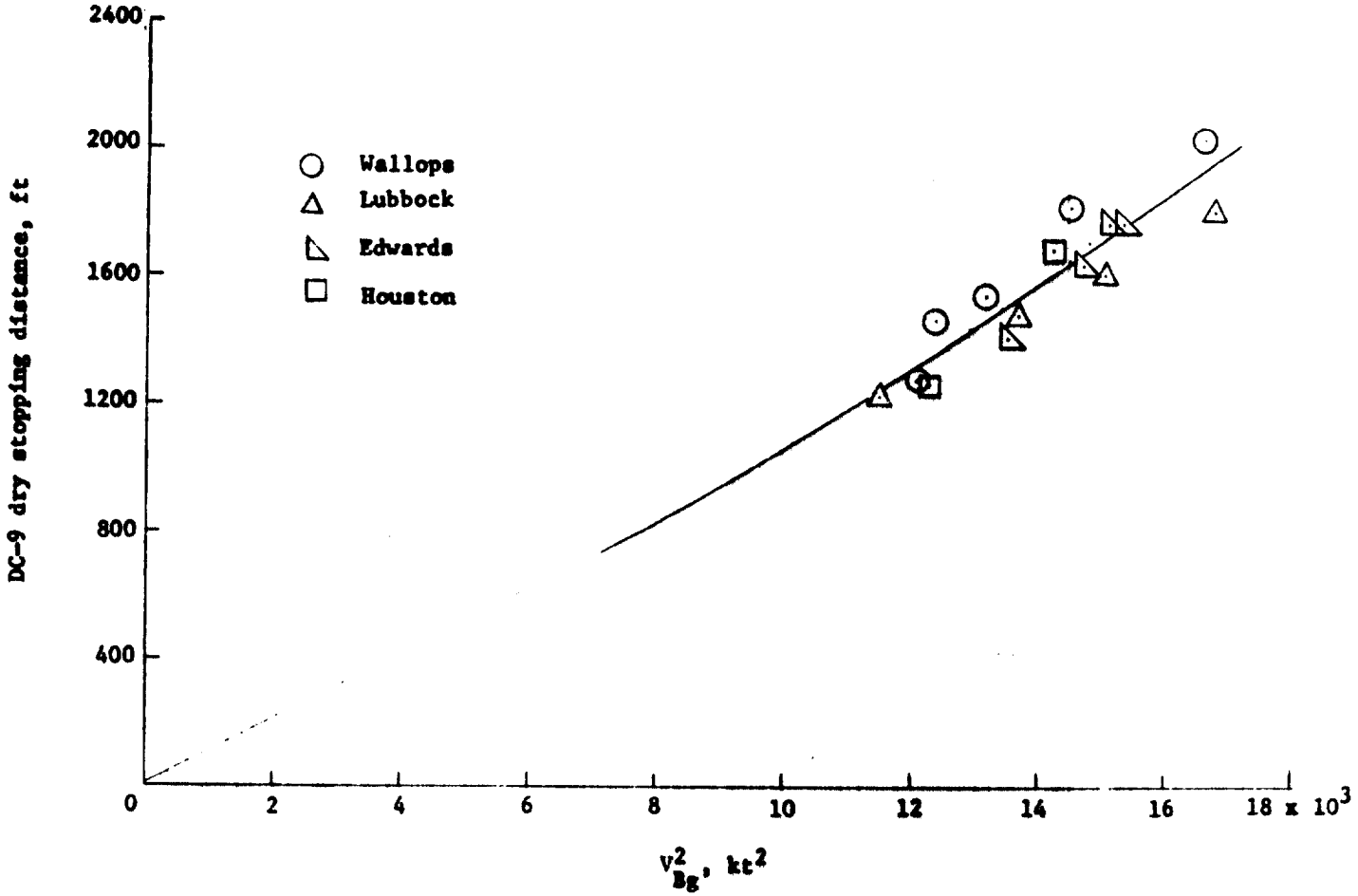
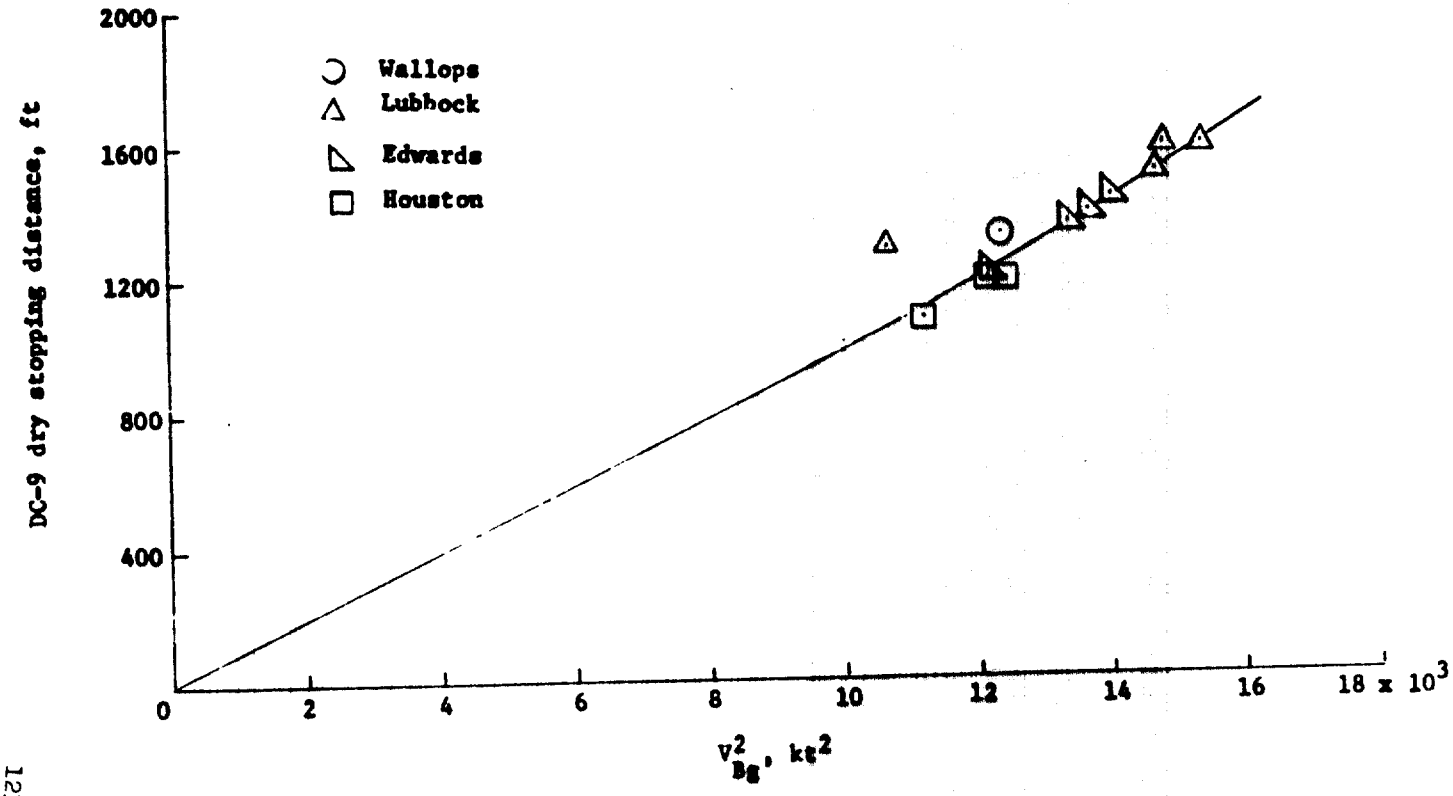


Figure 23.- Correlation between NASA nose wheel counter and Douglas phototheodolite stopping distance, brake application speed, and SDR (wet/dry) data for the DC-9 test aircraft.



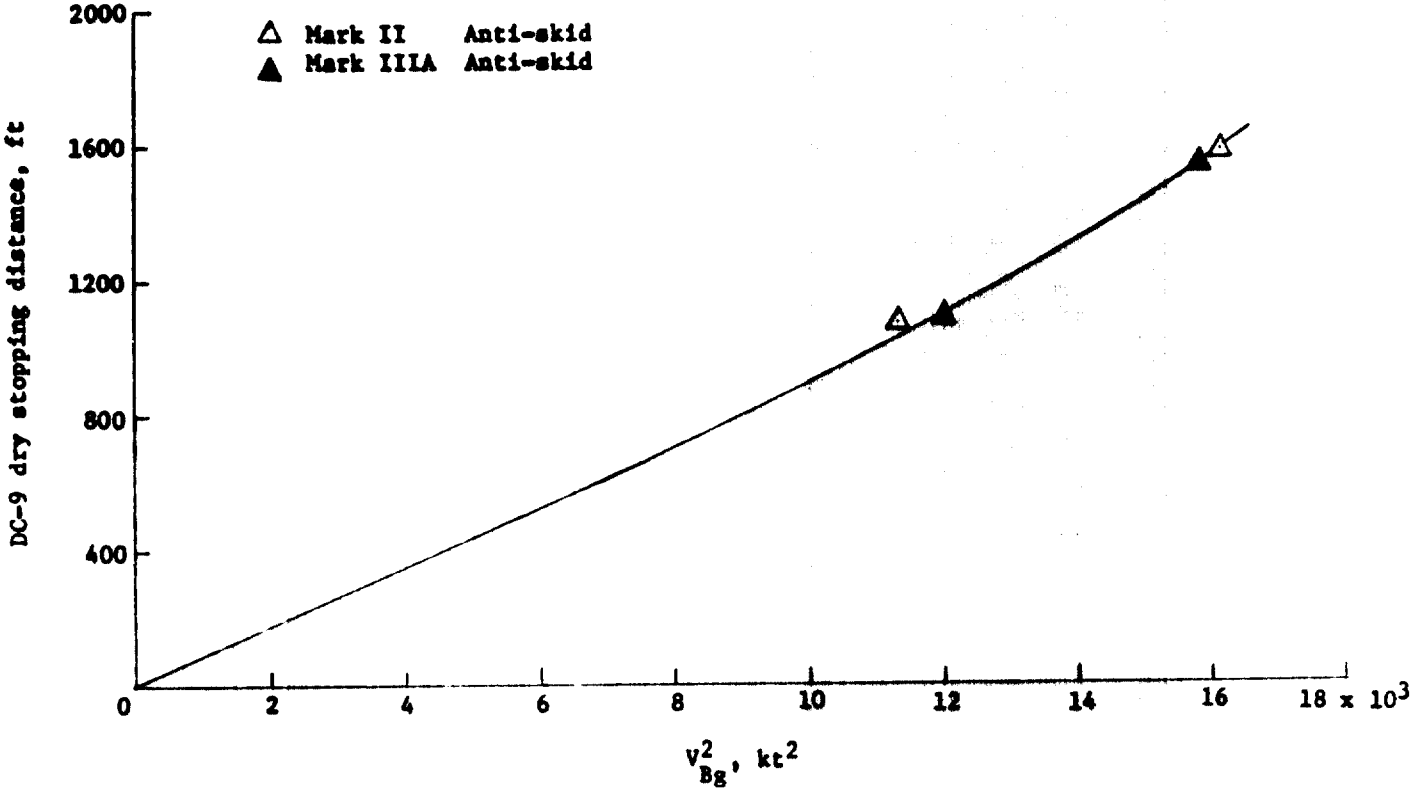
(a) Mark II anti-skid system. NASA data.

Figure 24.- Variation of DC-9 aircraft dry stopping distance with brake application speed squared.



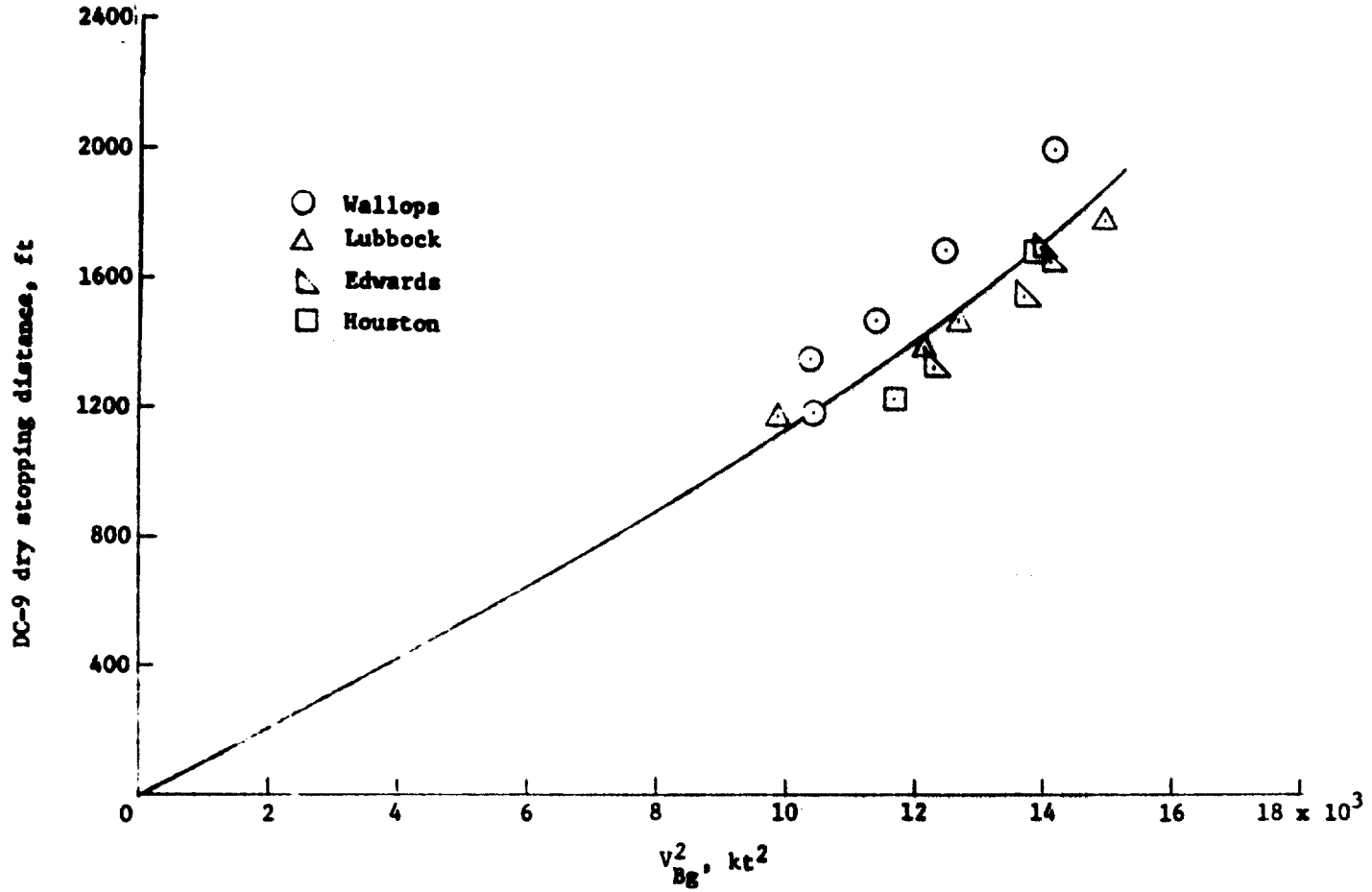
(b) Mark IIIA anti-skid system. NASA data.

Figure 24.- Continued.



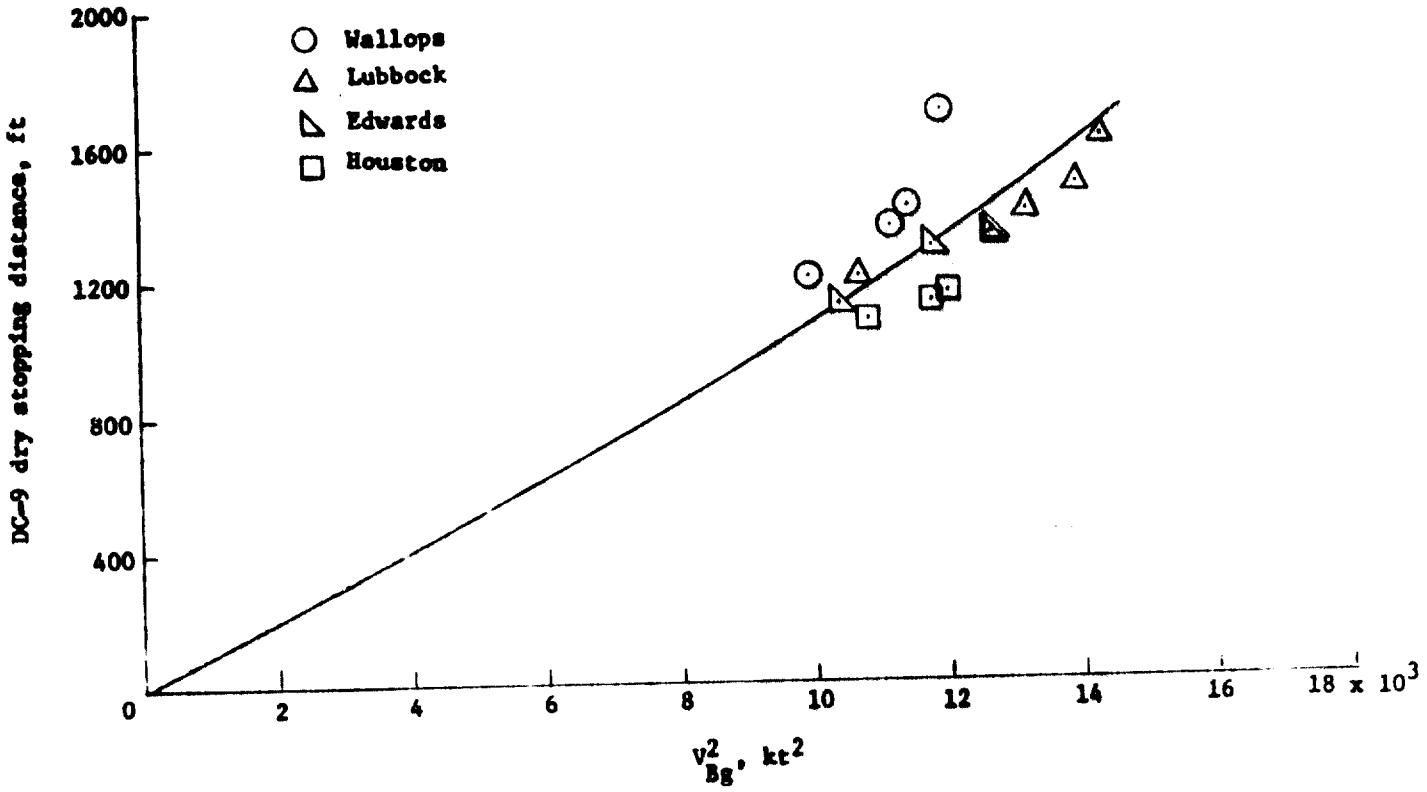
(c) Reverse thrust plus maximum braking. NASA data.

Figure 24.- Continued.



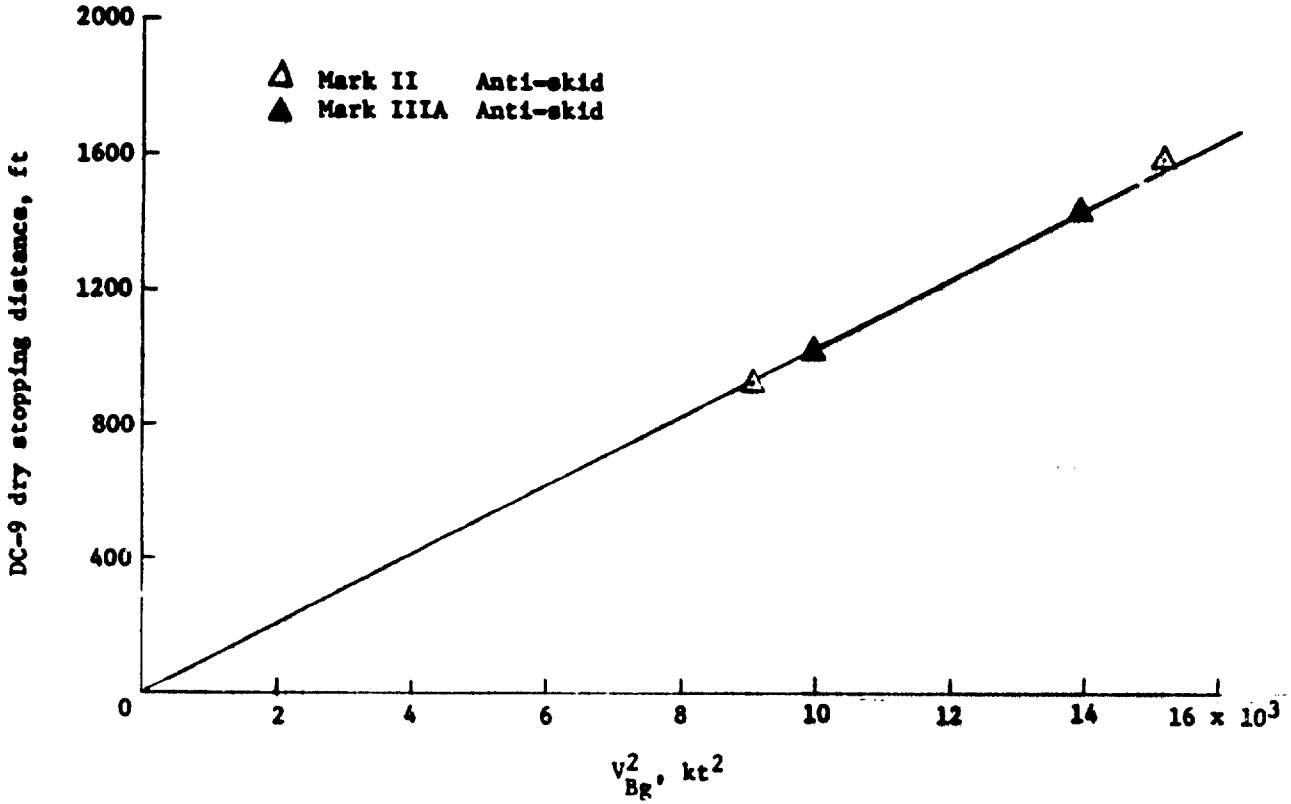
(d) Mark II anti-skid system. Douglas data.

Figure 24.- Continued.



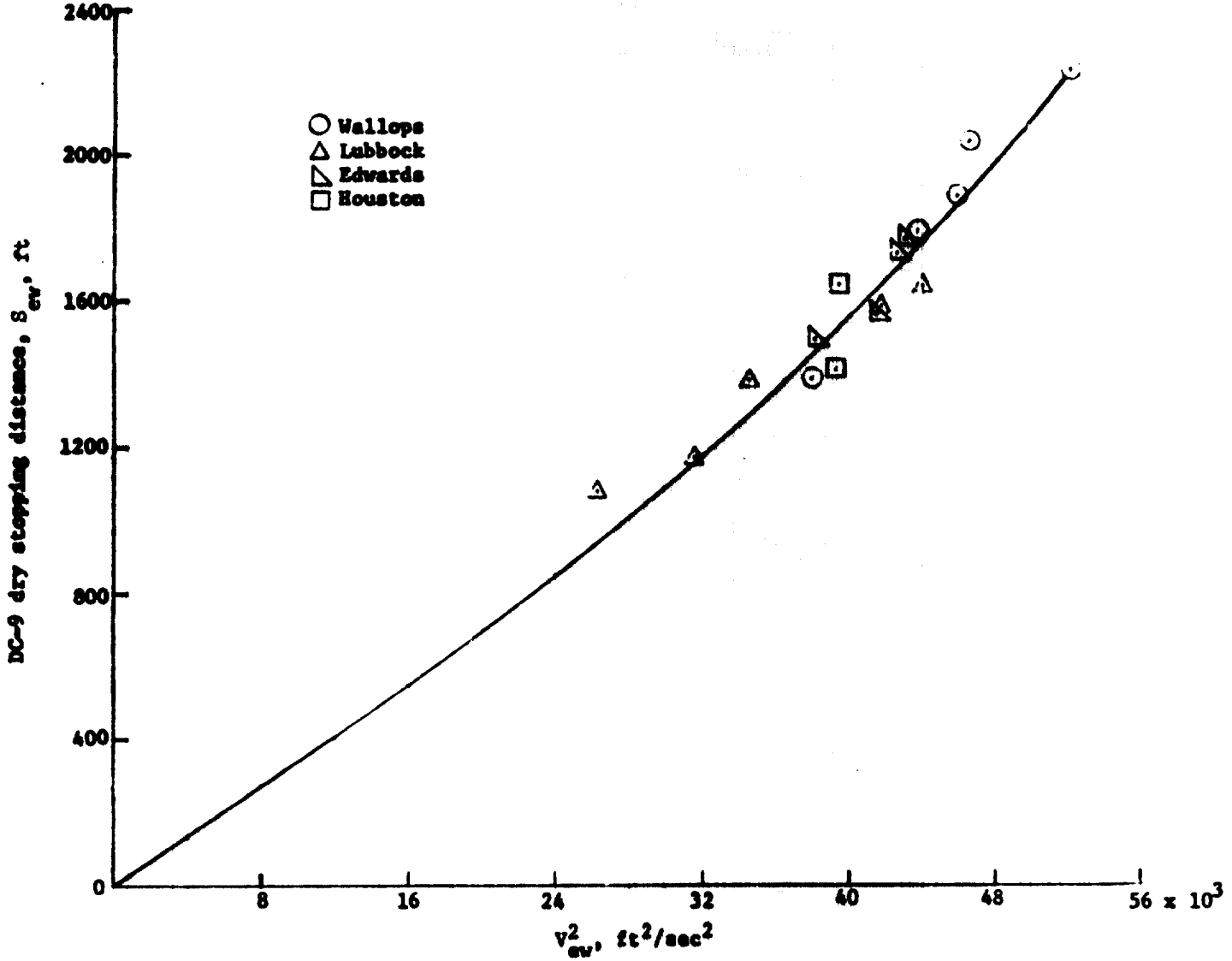
(e) Mark IIIA anti-skid system. Douglas data.

Figure 24.- Continued.



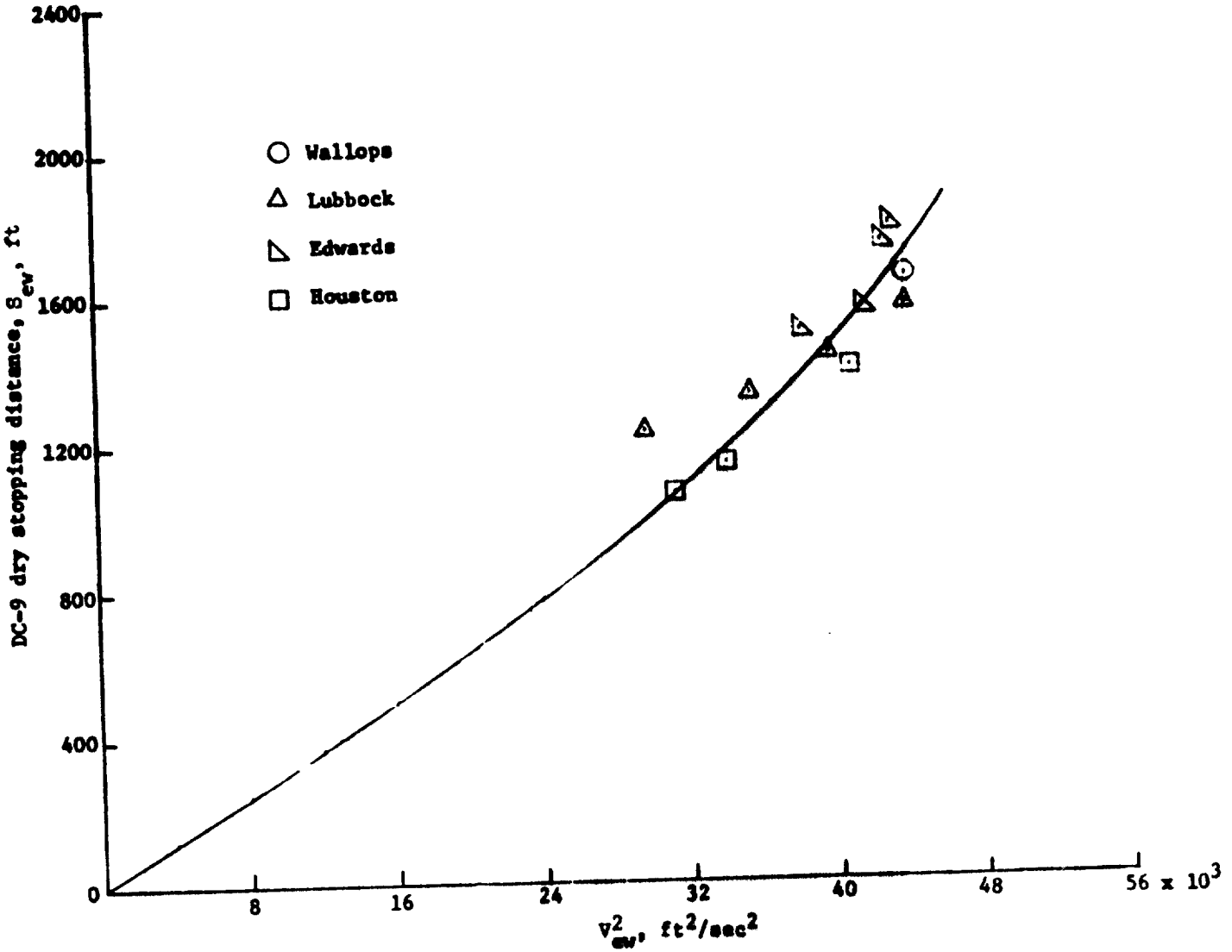
(f) Reverse thrust plus maximum brakes. Douglas data.

Figure 24.- Concluded.



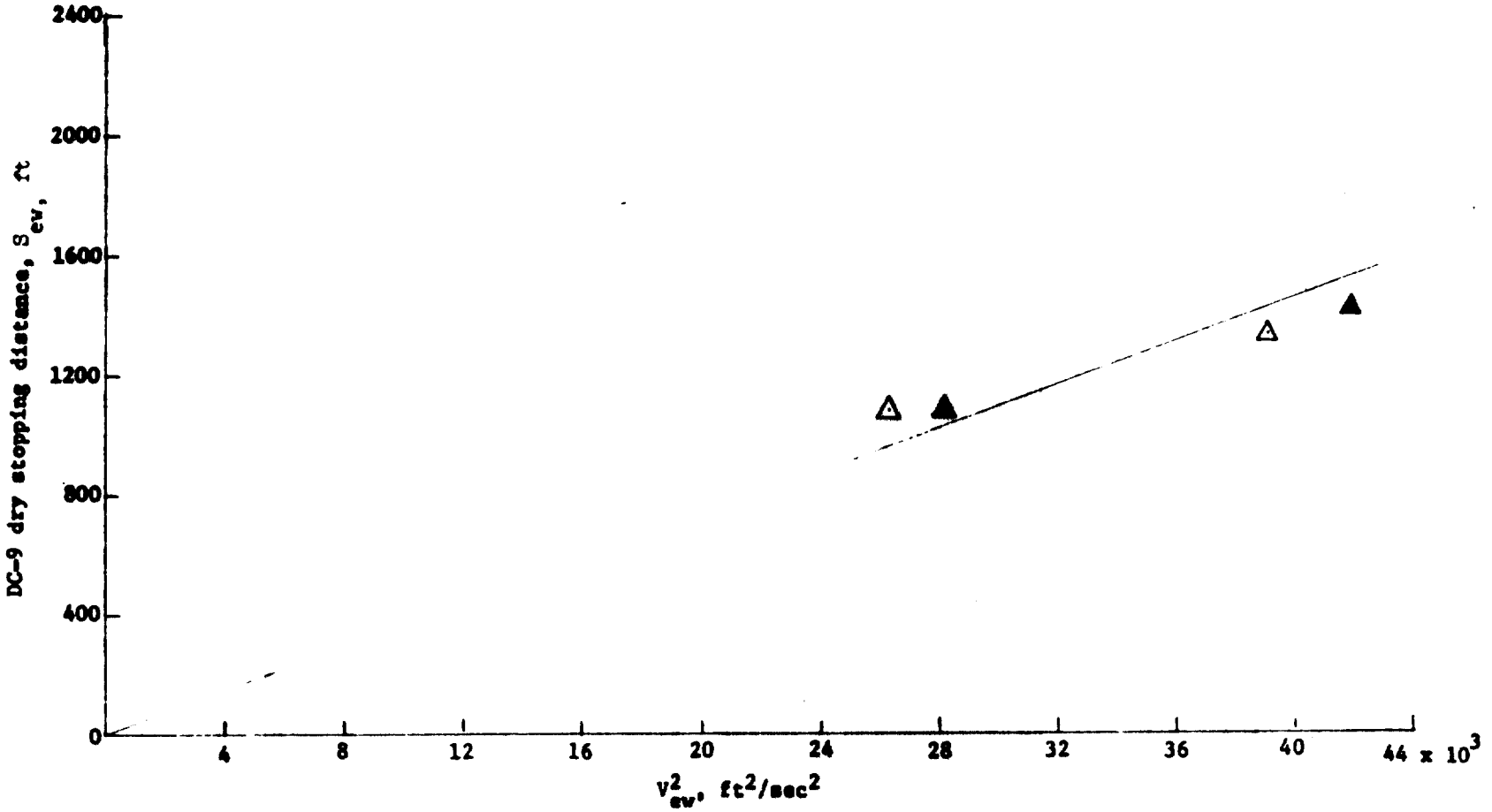
(a) Mark II anti-skid system. NASA data.

Figure 25.- Variation of DC-9 aircraft dry stopping distance with brake application speed squared at sea level, standard day, ar ' weight (80,000 lb) conditions.



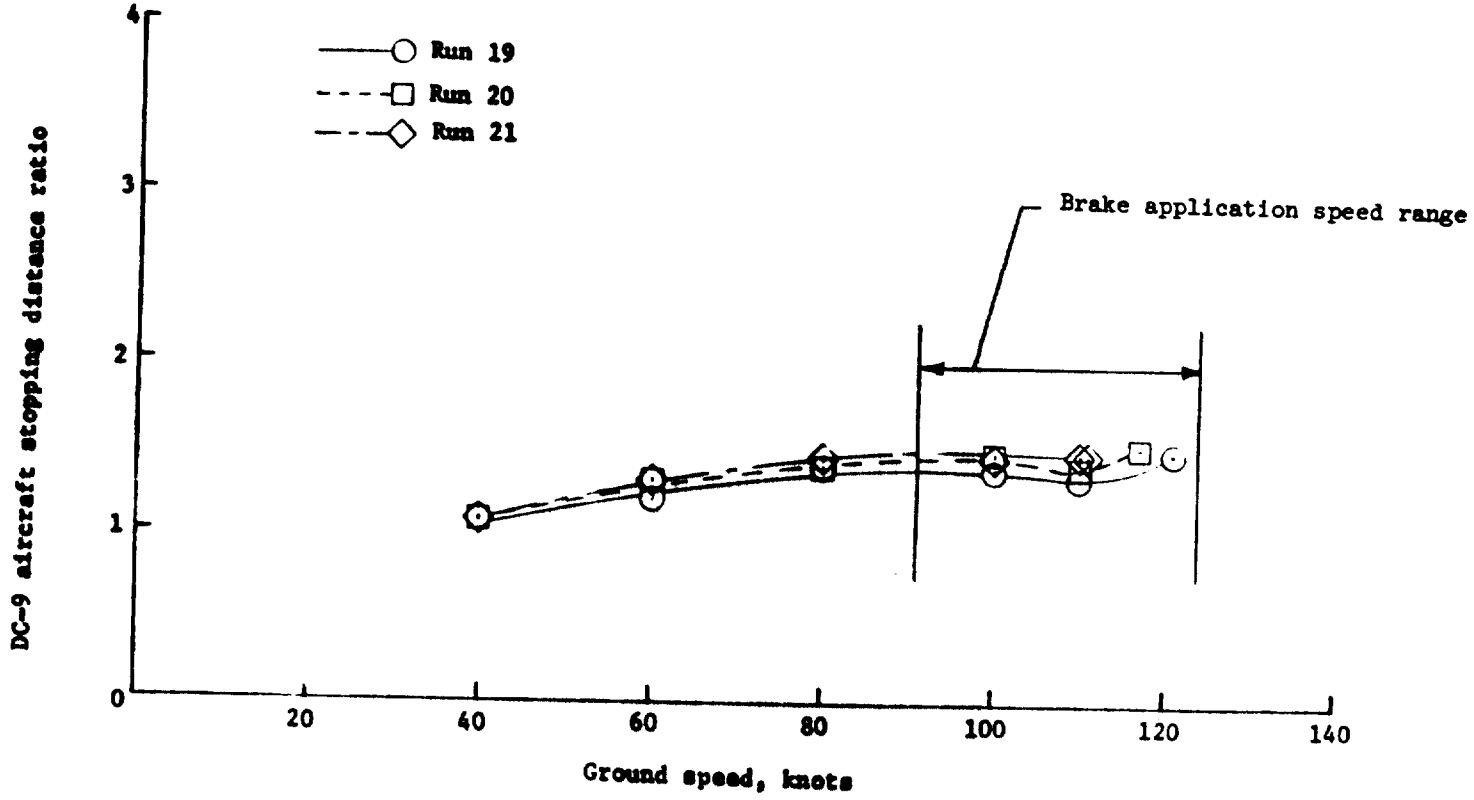
(b) Mark IIIA anti-skid system. NASA data.

Figure 25.- Continued.



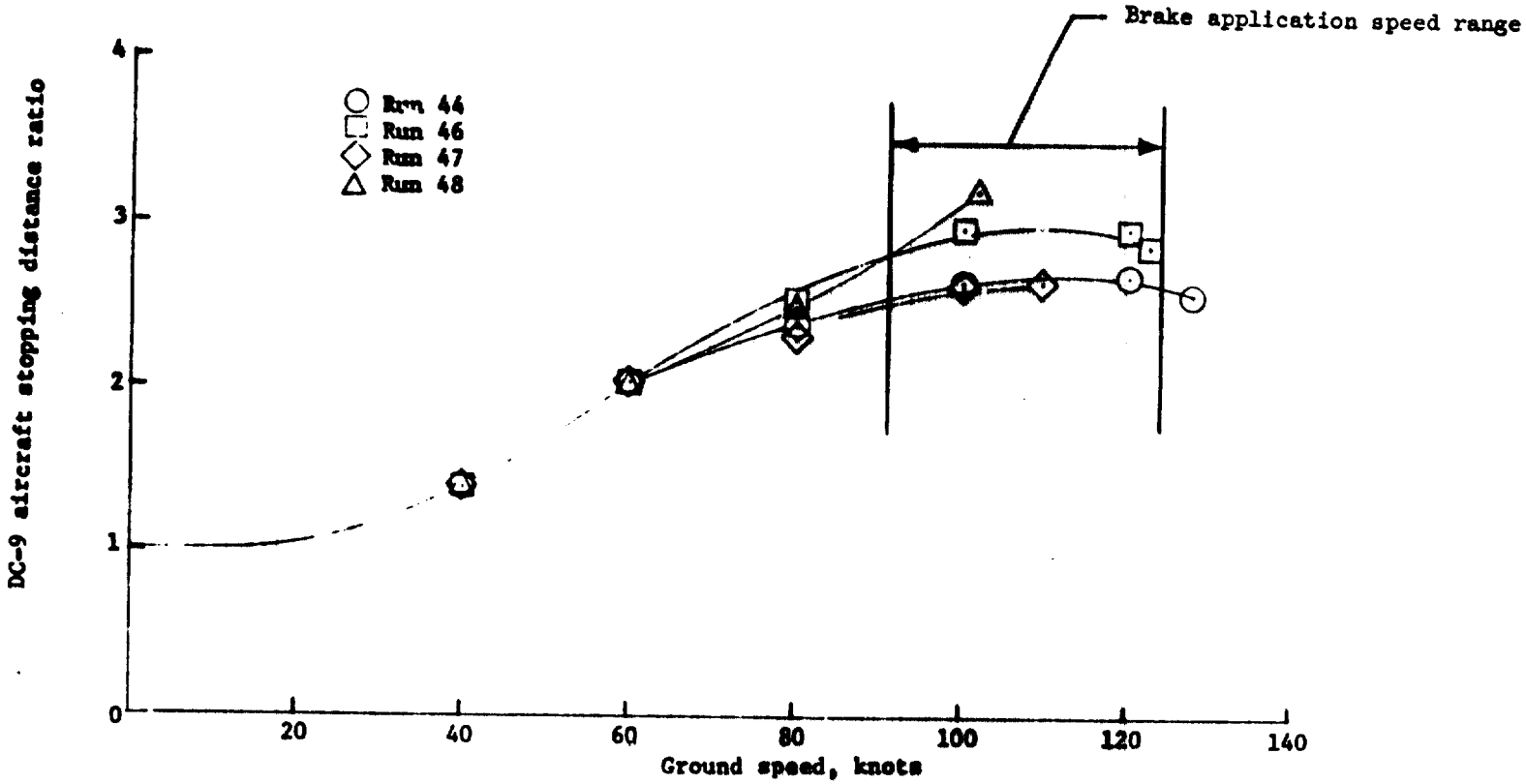
(c) Reverse thrust plus maximum braking. NASA data.

Figure 25.- Concluded.



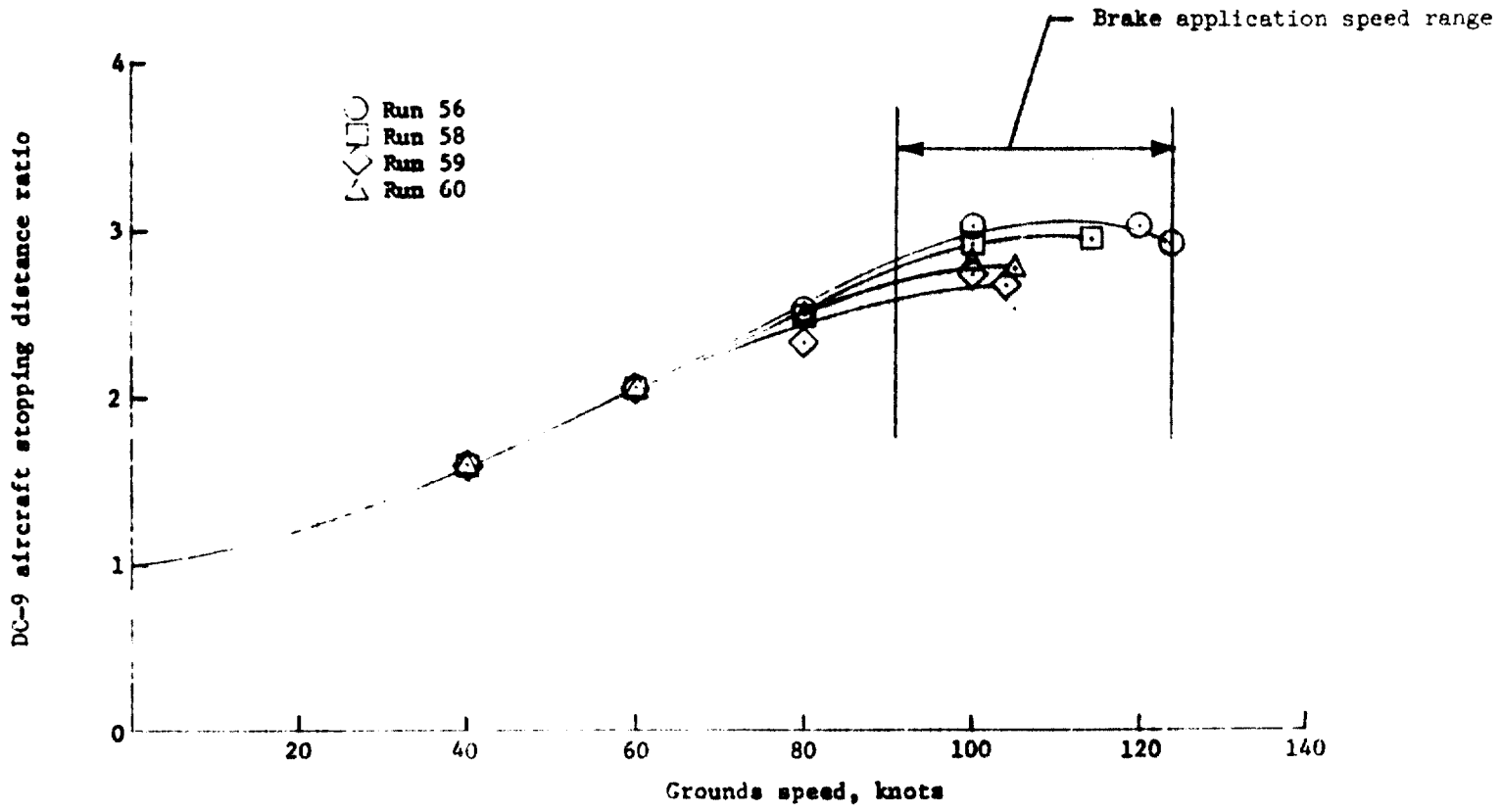
(a) Wallops, Mark II anti-skid system.

Figure 26.- Variation of DC-9 aircraft stopping distance ratio with ground speed.



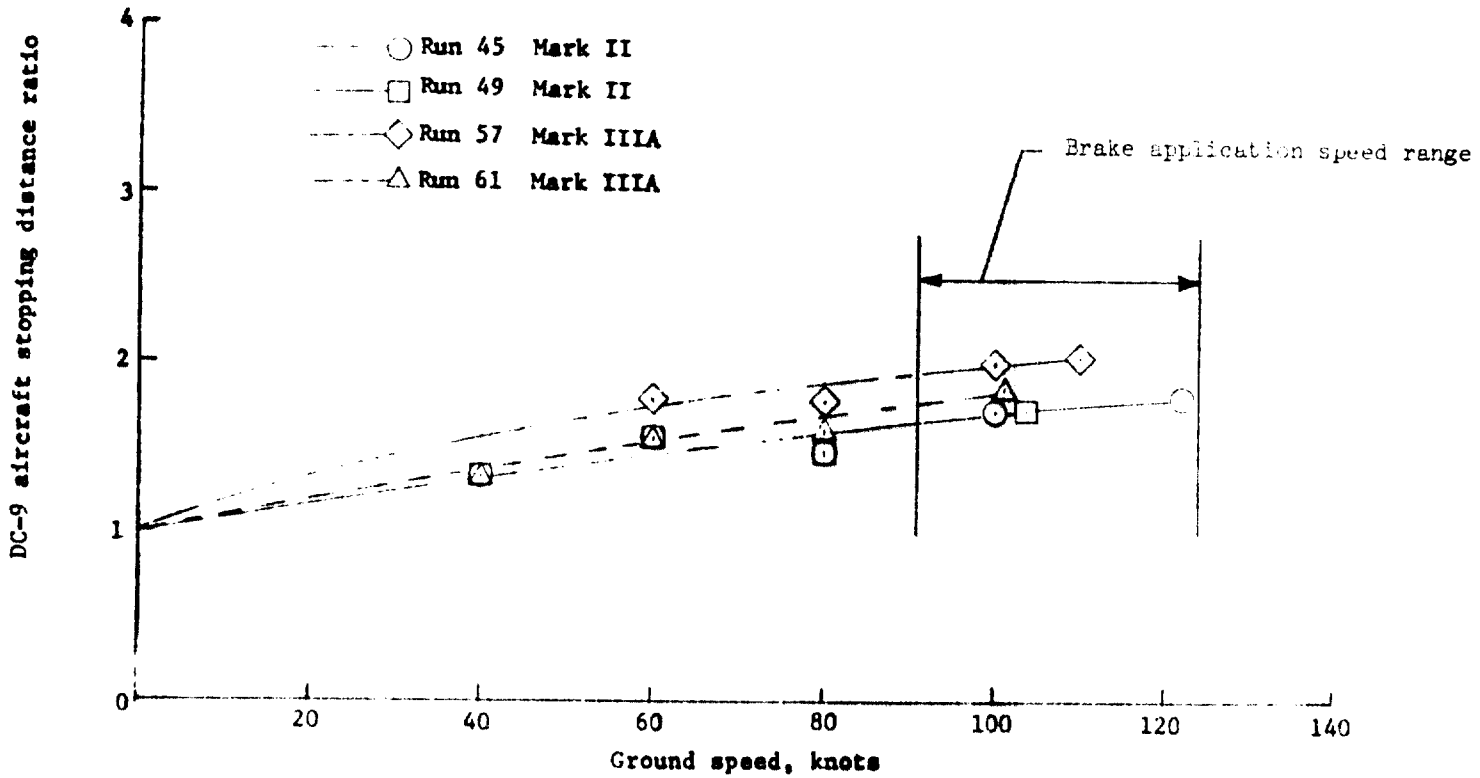
(b) Lubbock, Mark II anti-skid system.

Figure 26.- Continued.



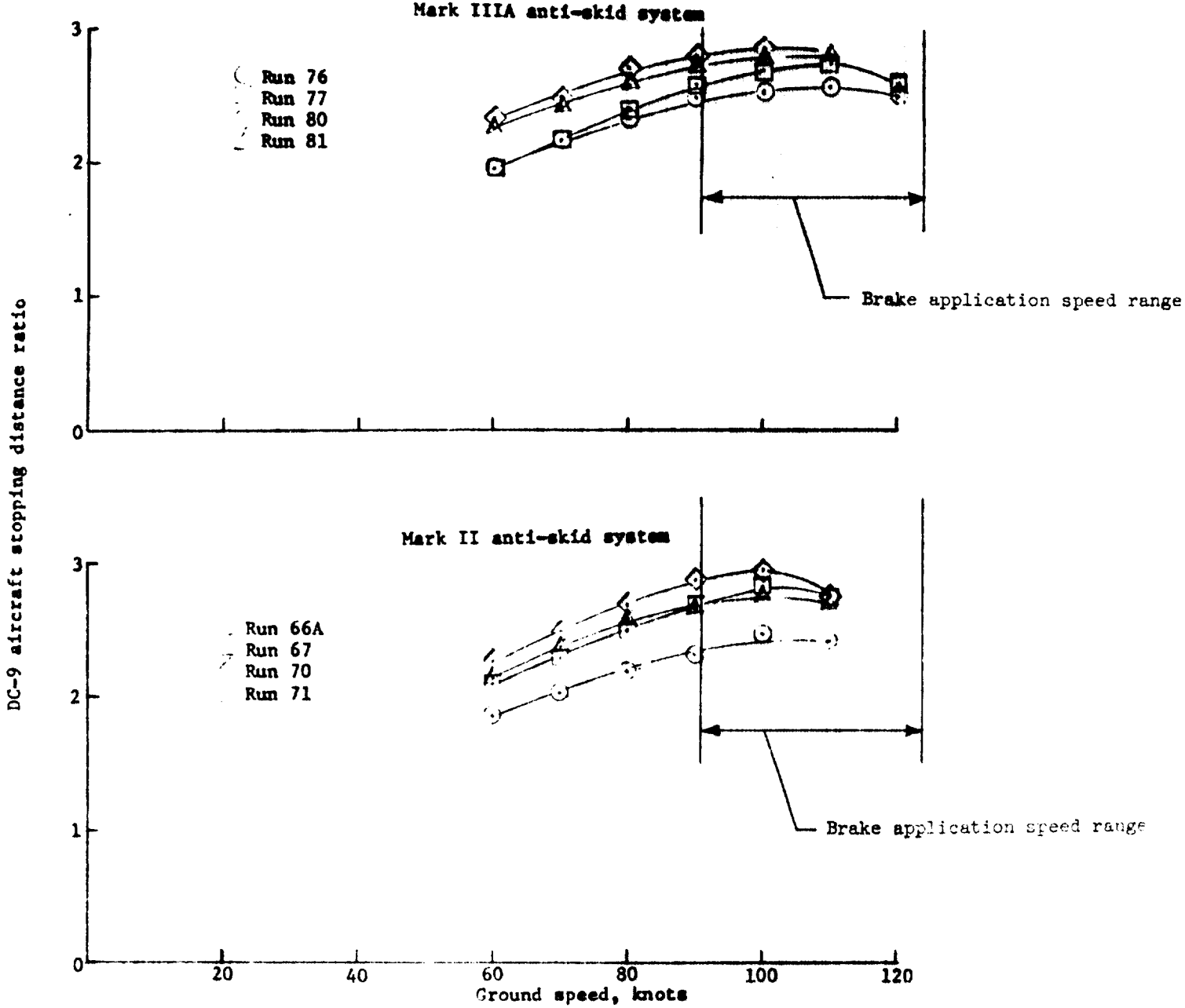
(c) Lubbock, Mark IIIA anti-skid system

Figure 26.- Continued.



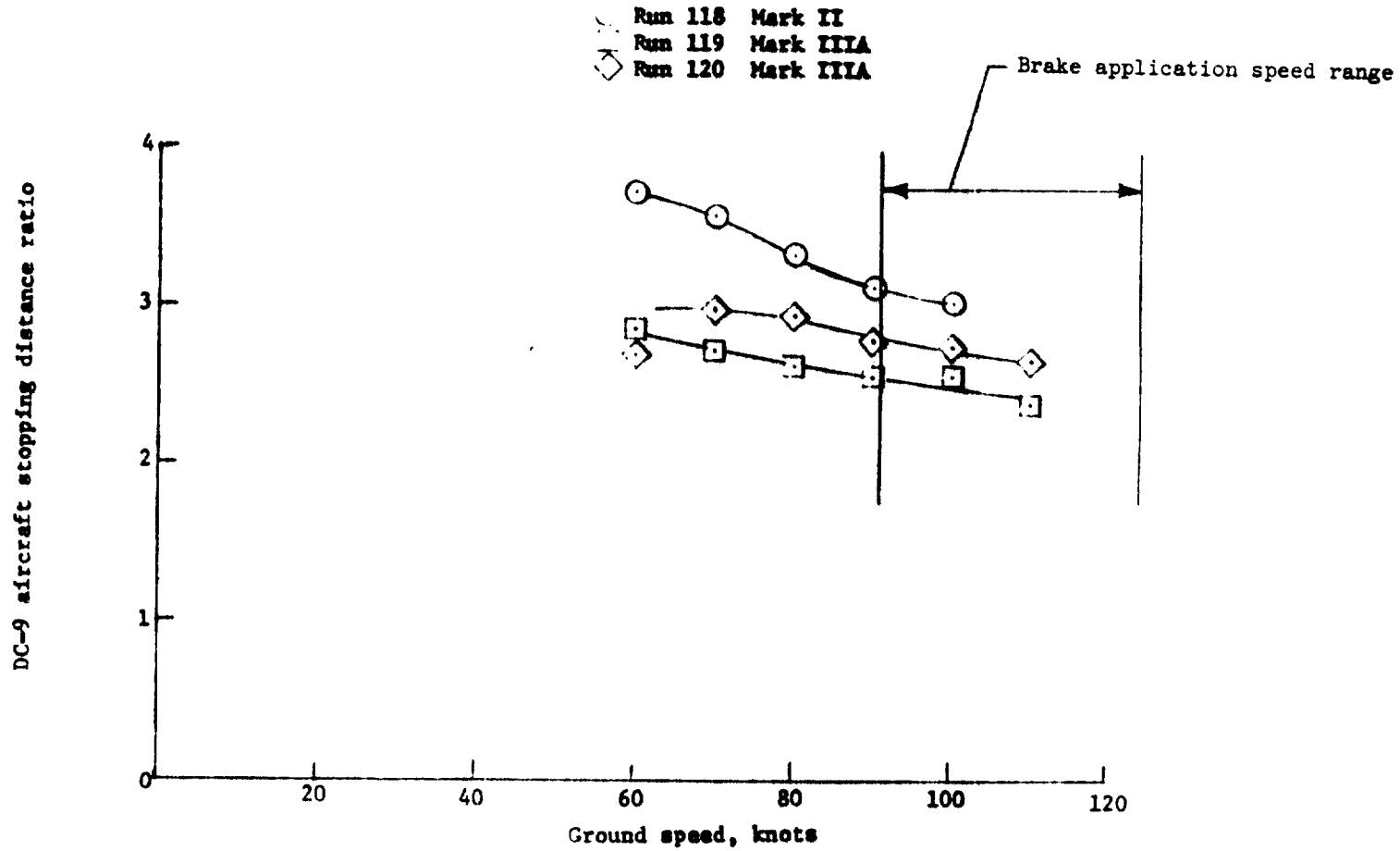
(d) Lubbock, reverse thrust plus maximum braking.

Figure 26.- Continued.



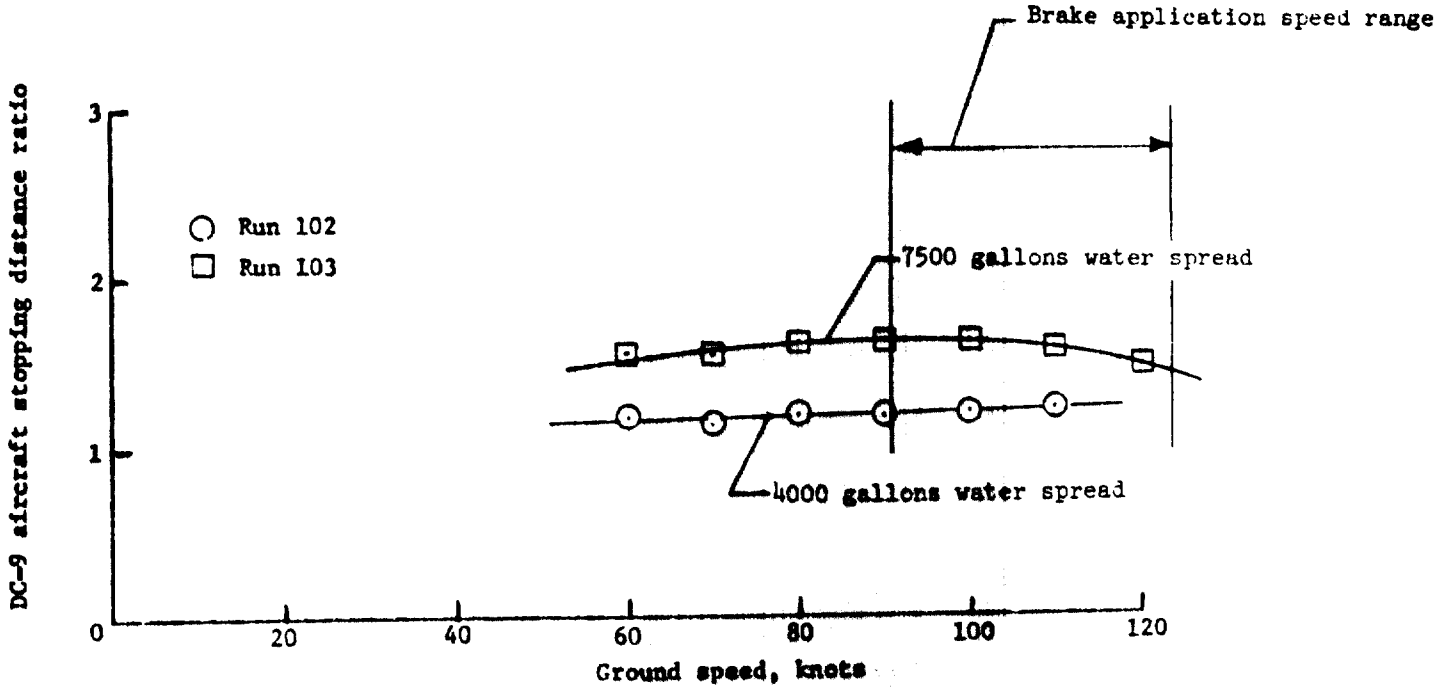
(e) Edwards, Mark II and Mark IIIA anti-skid systems.

Figure 26.- Continued.



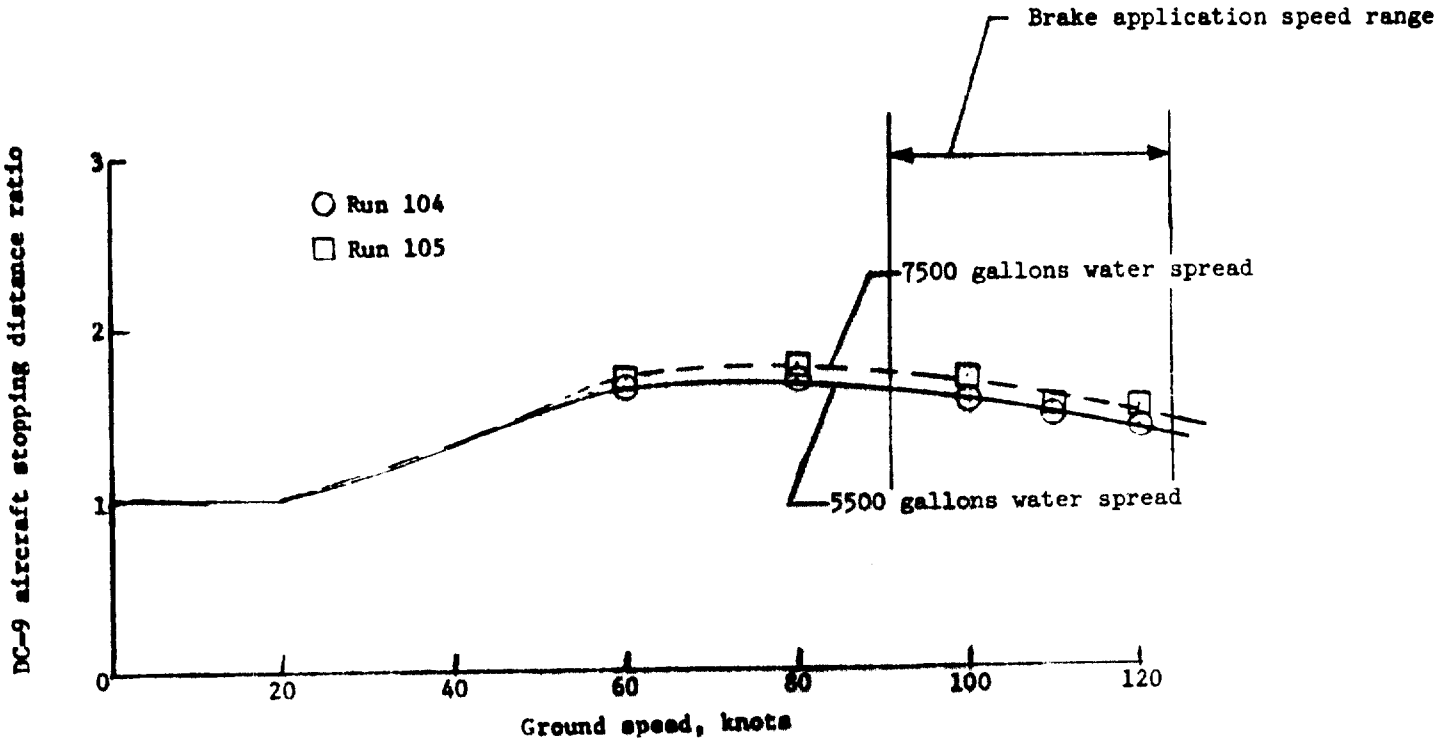
(f) Edmonton, Mark II and Mark IIIA systems.

Figure 26.- Continued.



(g) Houston, Mark II anti-skid system.

Figure 26.- Continued.



(h) Houston, Mark IIIA anti-skid system.

Figure 26.- Concluded.

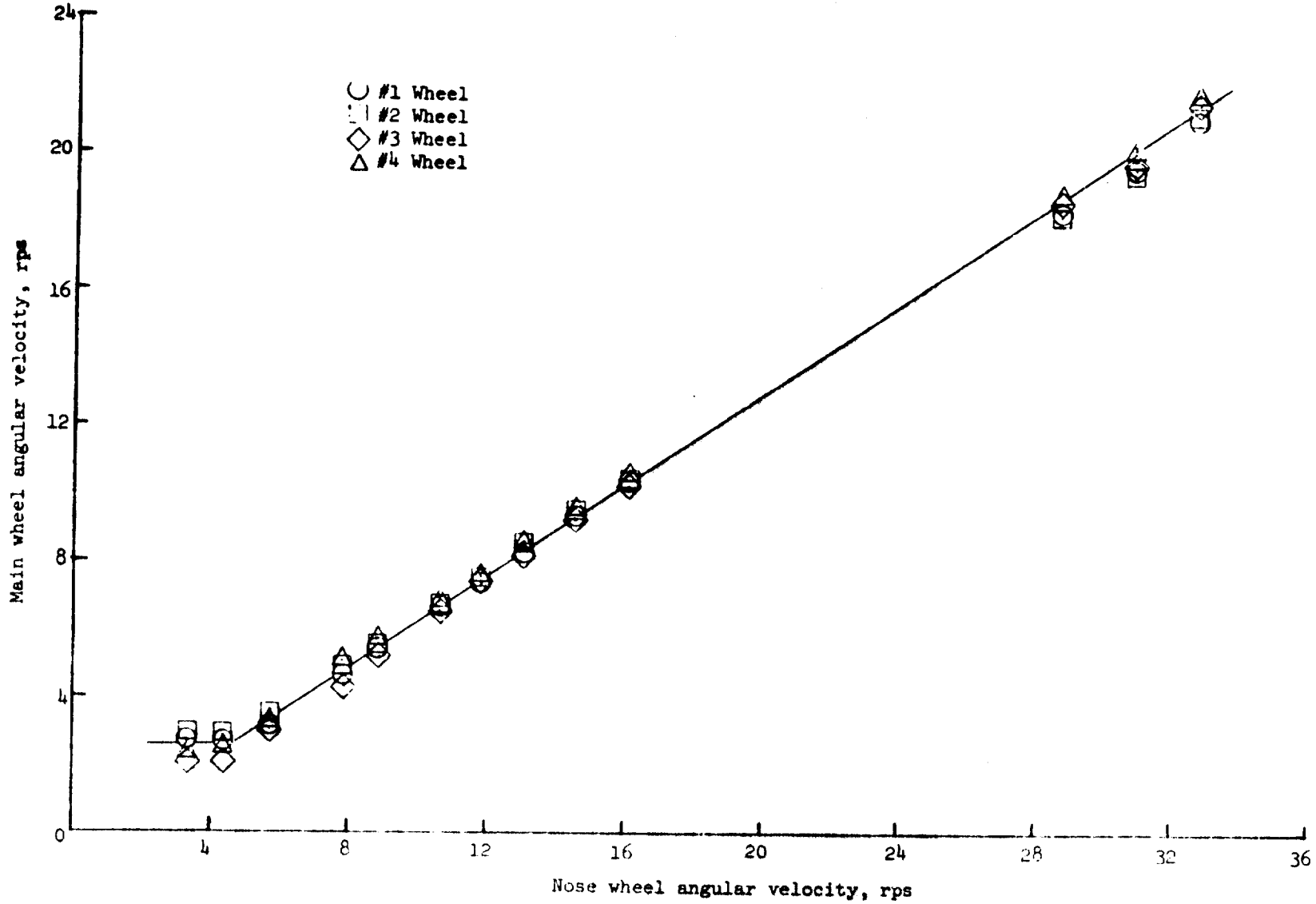
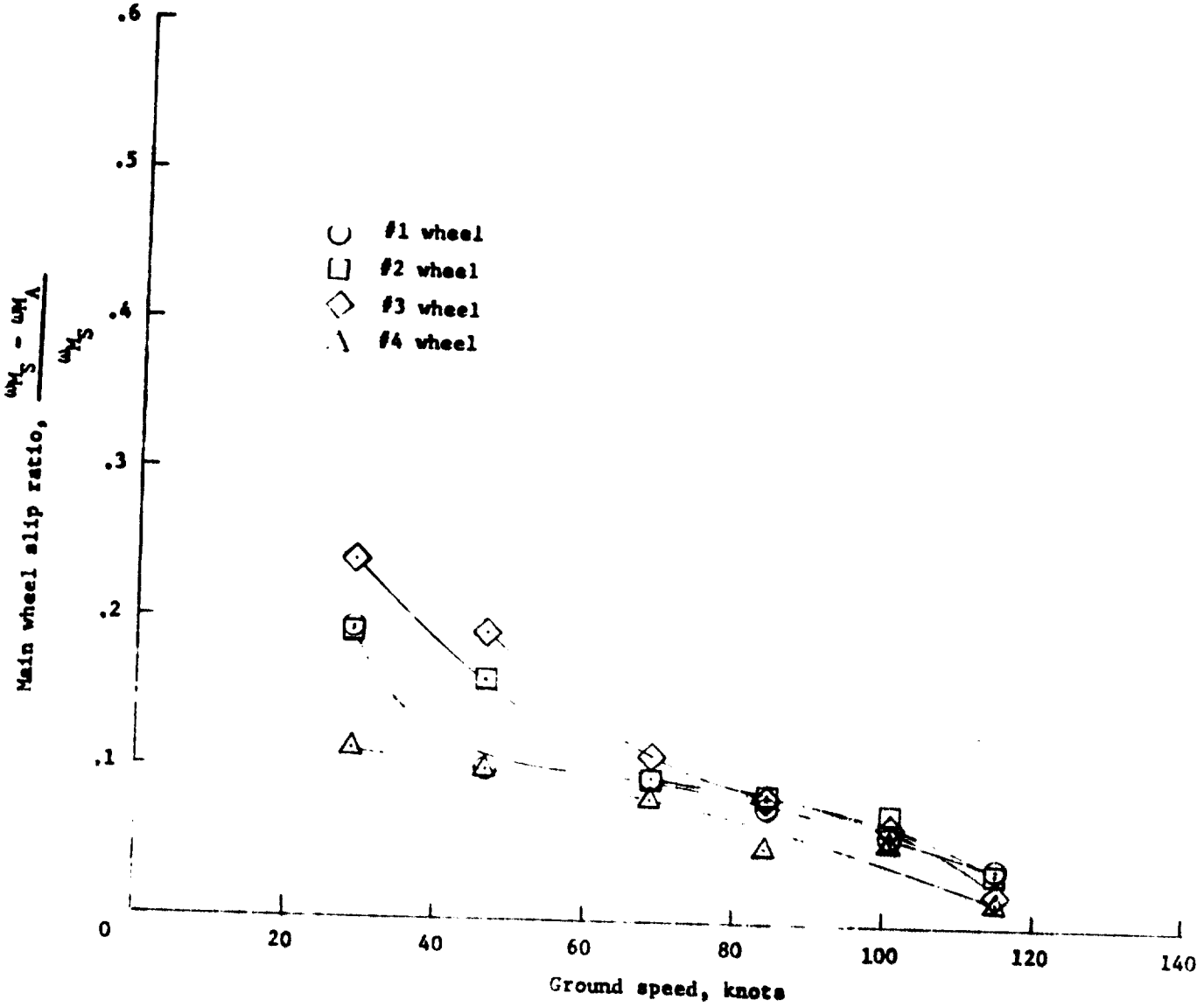
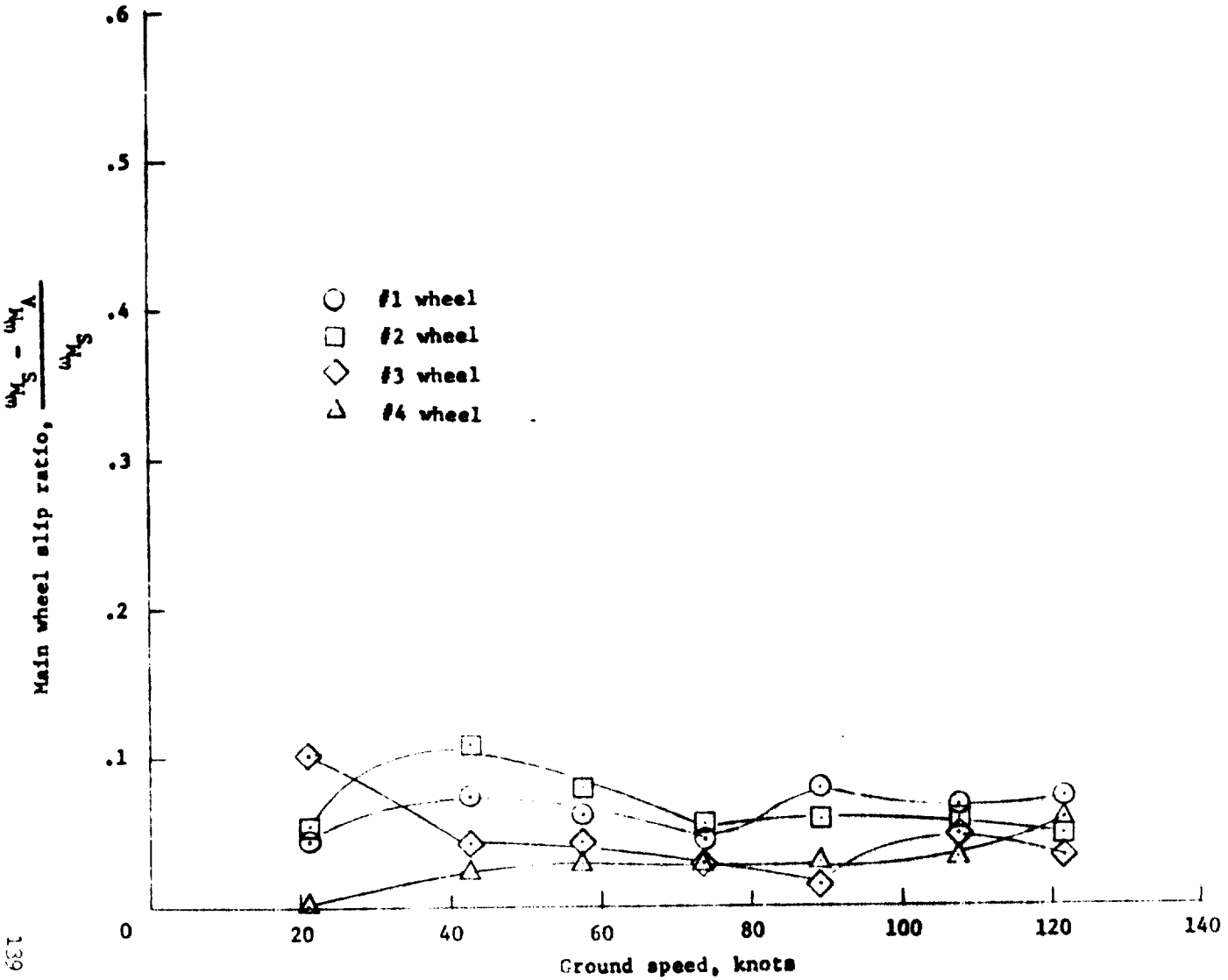


Figure 27.- Comparison of DC-9 main and nose wheel angular velocity under free roll (no braking) conditions.



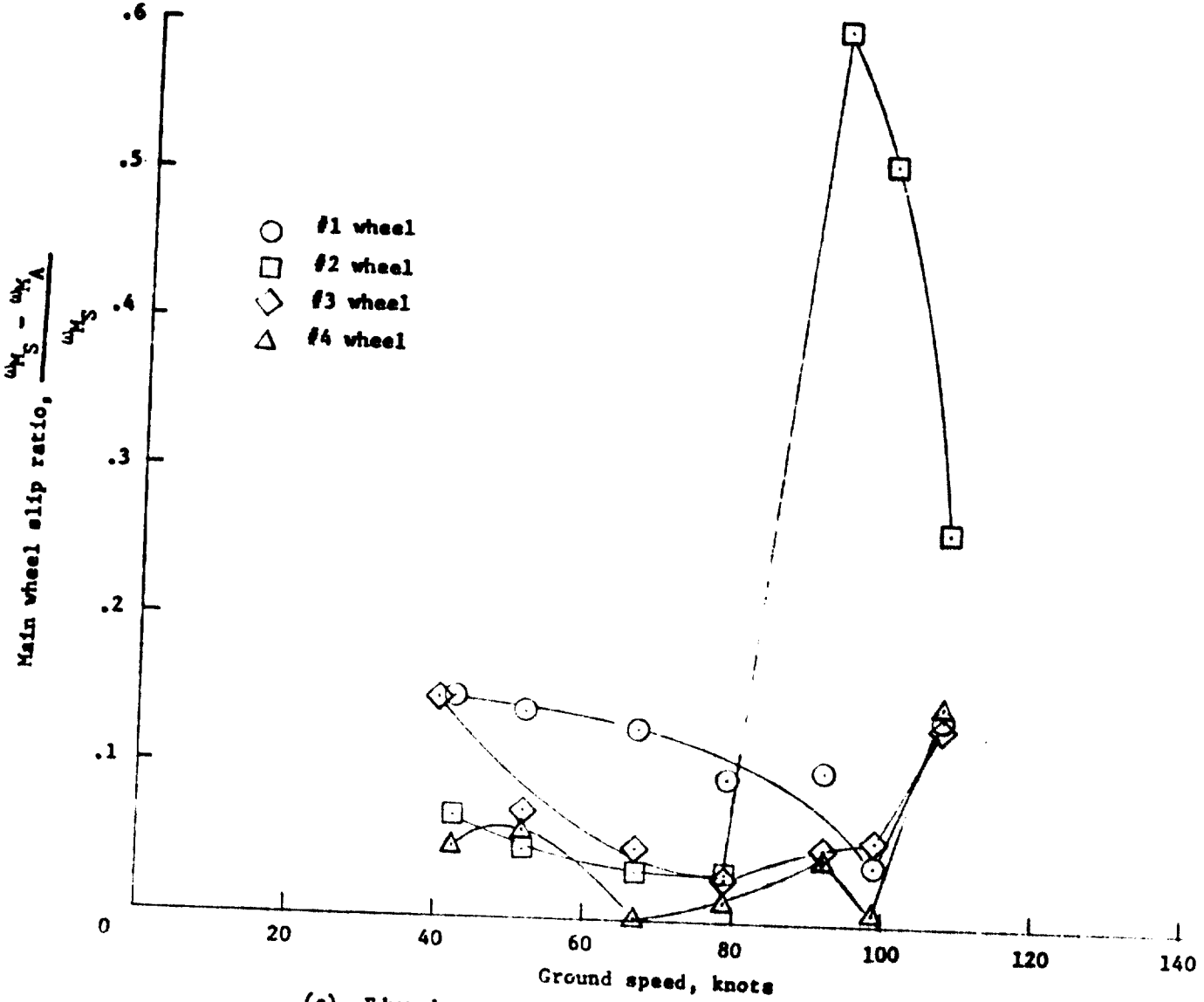
(a) Edwards, run no. 65. dry, Mark II anti-skid system.

Figure 28 - Variation of DC-9 aircraft main wheel slip ratio with ground speed.



(b) Houston, run no. 103, wet, Mark IIIA anti-skid system.

Figure 28.- Continued.



(c) Edwards, run no. 70, wet, Mark II anti-skid system.

Figure 28.- Concluded.

Open symbols - MK II anti-skid
Solid symbols - MK IIIA anti-skid
"L" Flagged symbols - reverse thrust plus max brakes

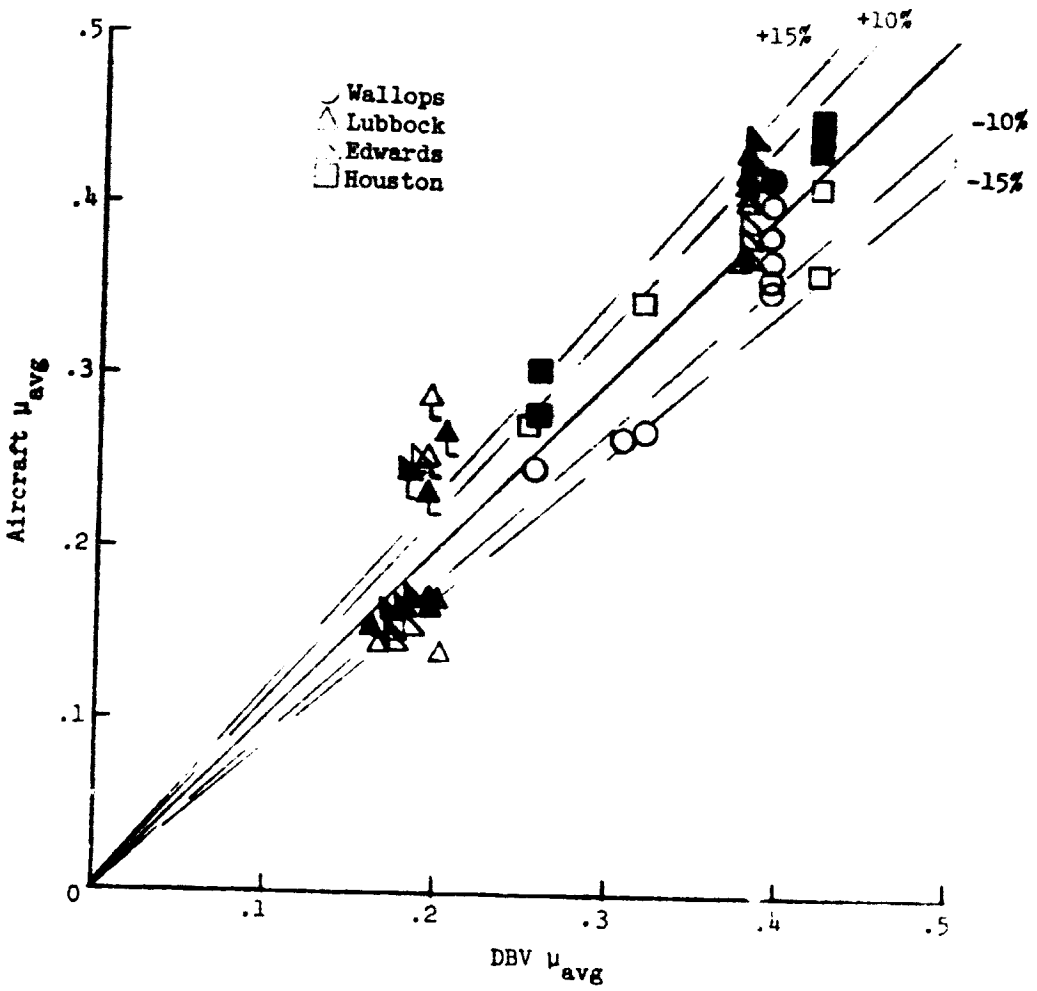
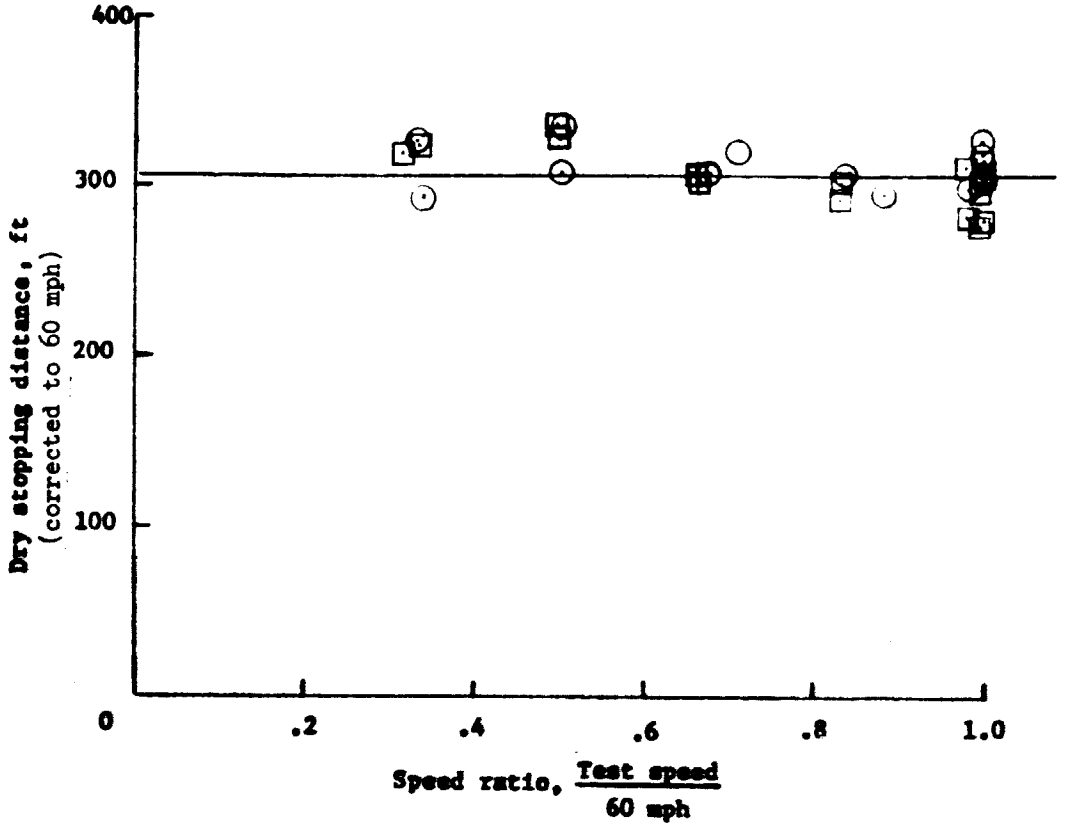
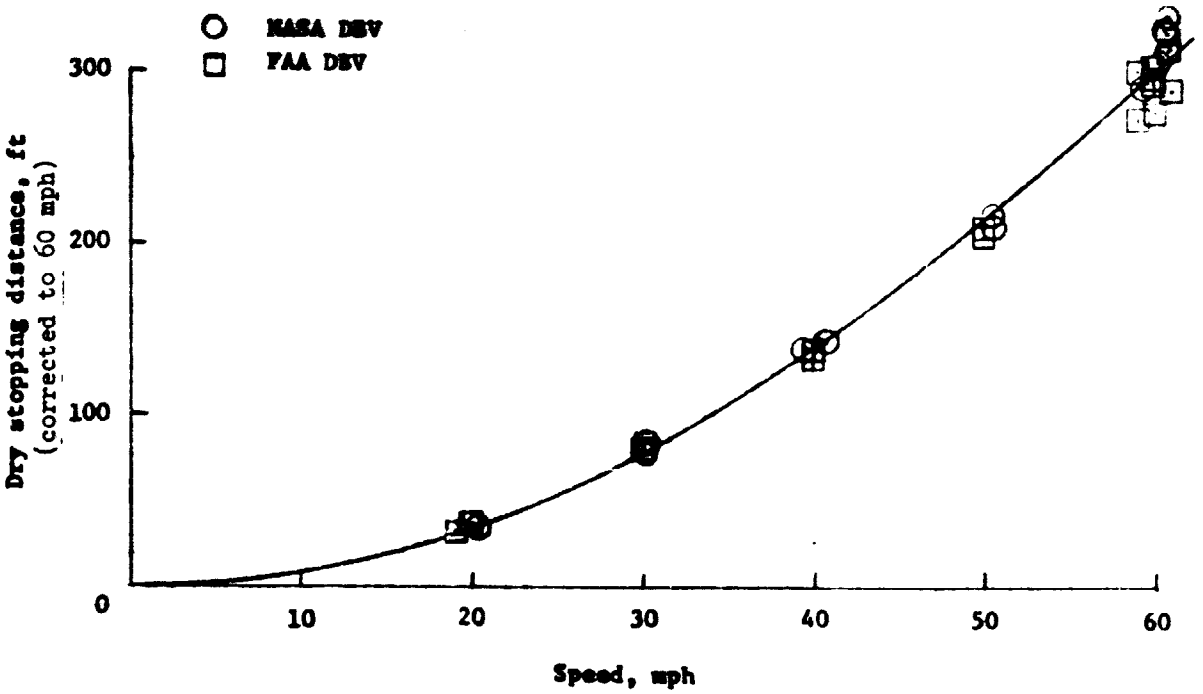


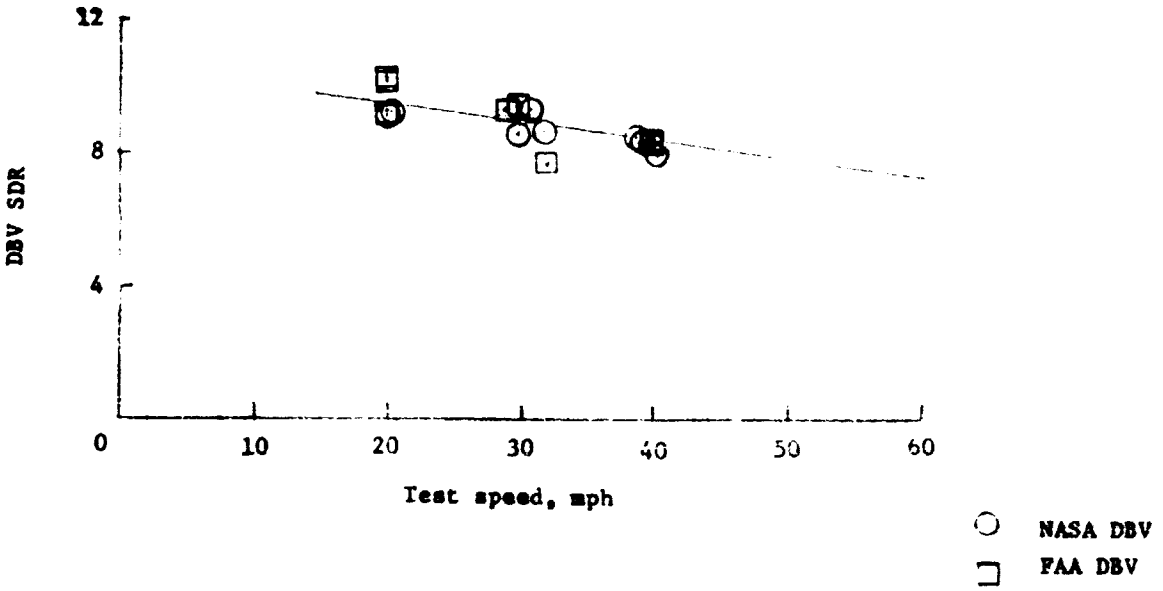
Figure 29.- Comparison of DC-9 and DBV average friction coefficient.

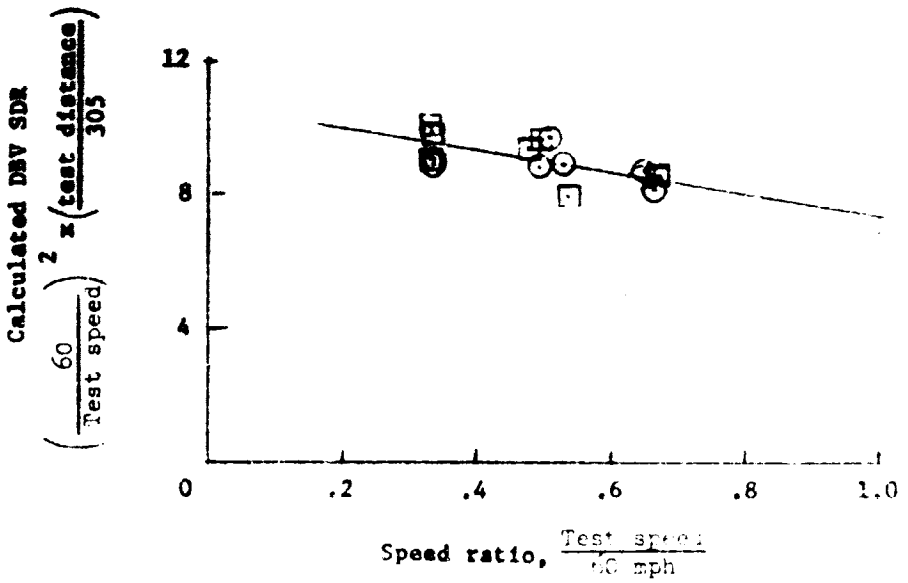




(a) Dry surface condition

Figure 30.- Evaluation of DSV stopping distance values obtained through speed range under various surface conditions.





(b) Glare ice at ambient air temperature of 20 - 21 °F.

Figure 30.- Concluded.

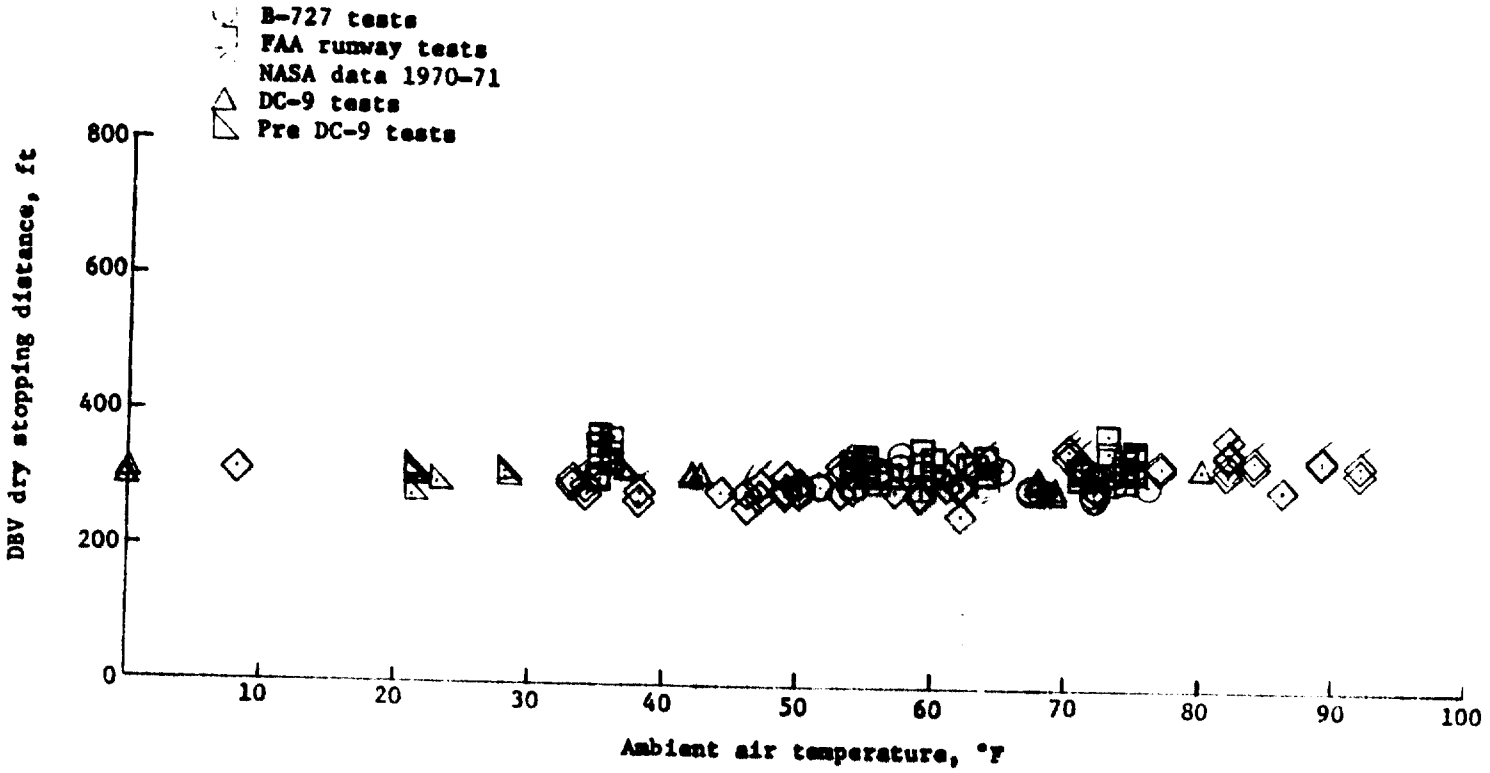


Figure 31.- Comparison of DBV dry stopping distance values with ambient air temperature.

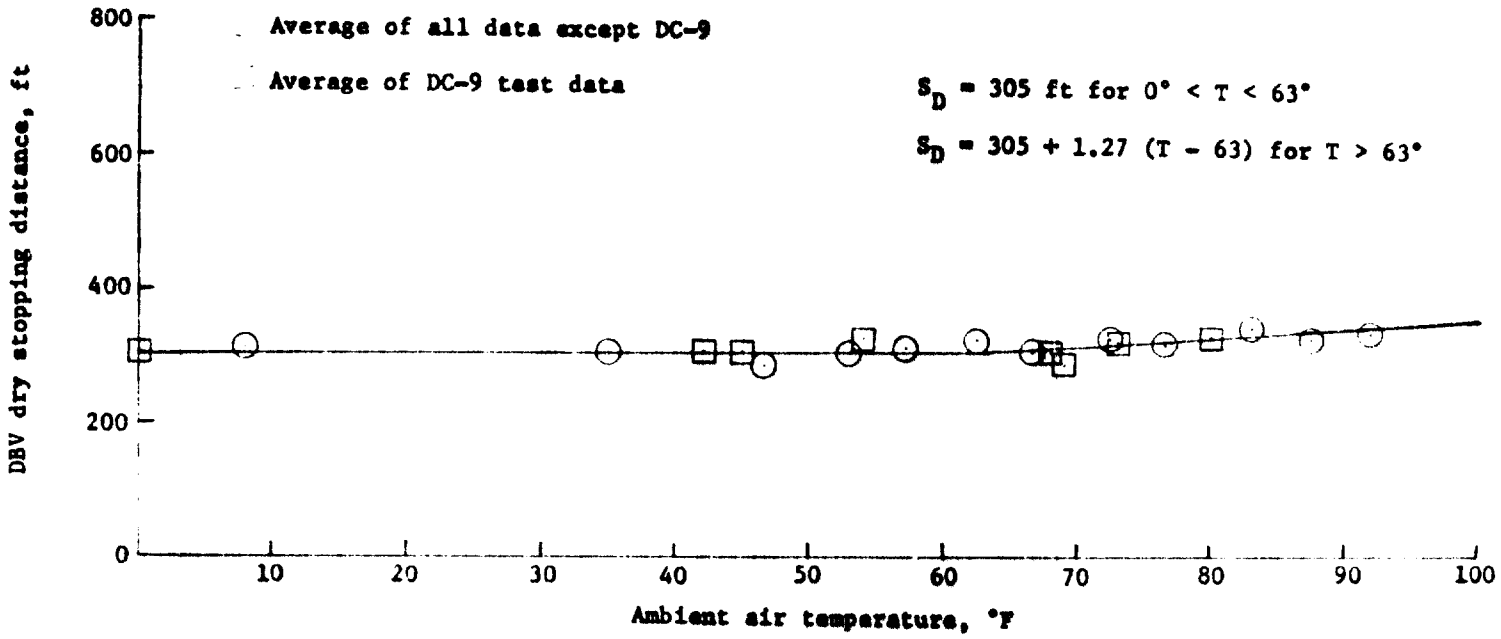


Figure 32.- Data averaging evaluation of DBV dry stopping distance variation with ambient air temperature.

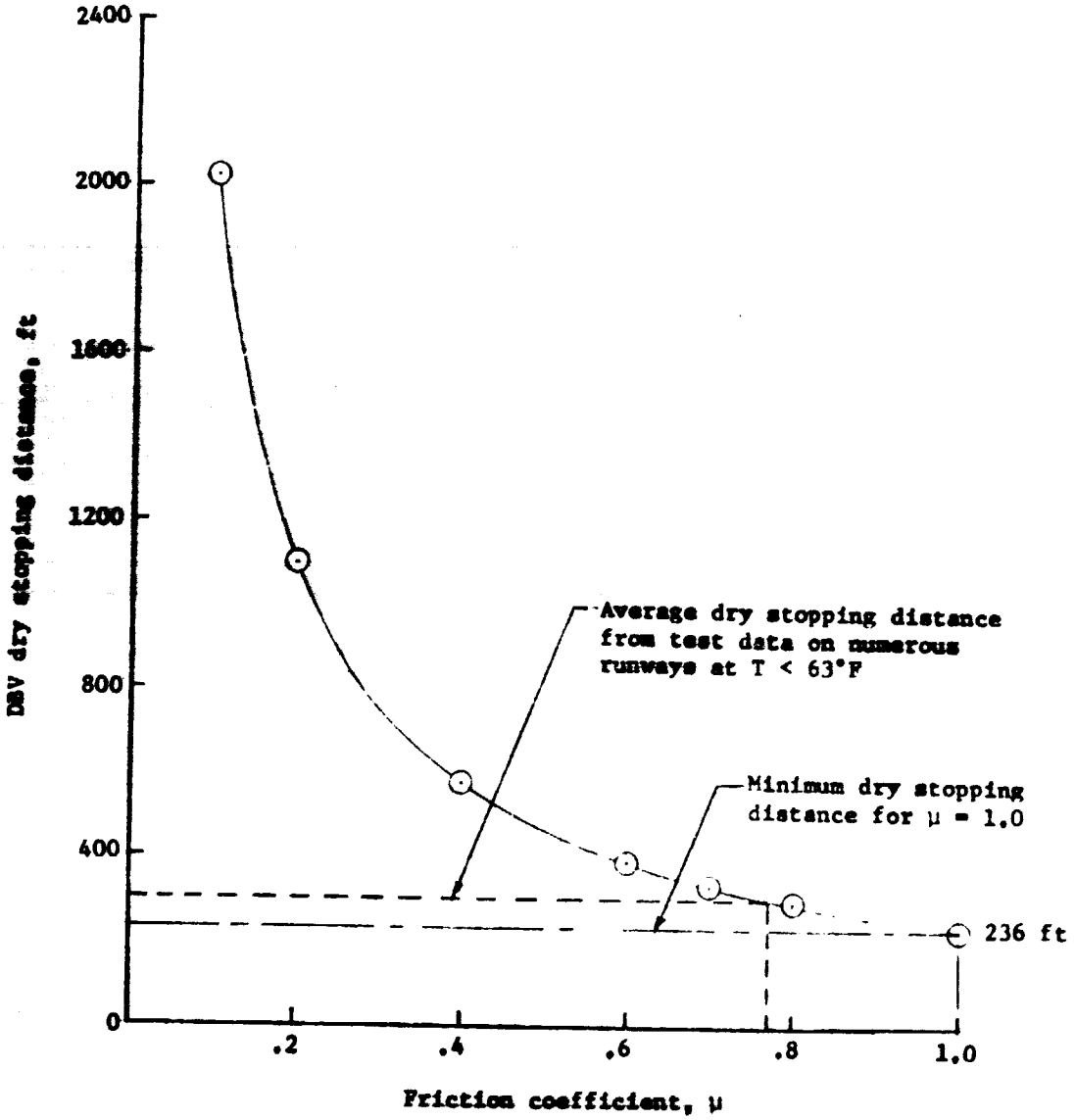


Figure 33.- Variation of DBV dry stopping distance with friction coefficient.

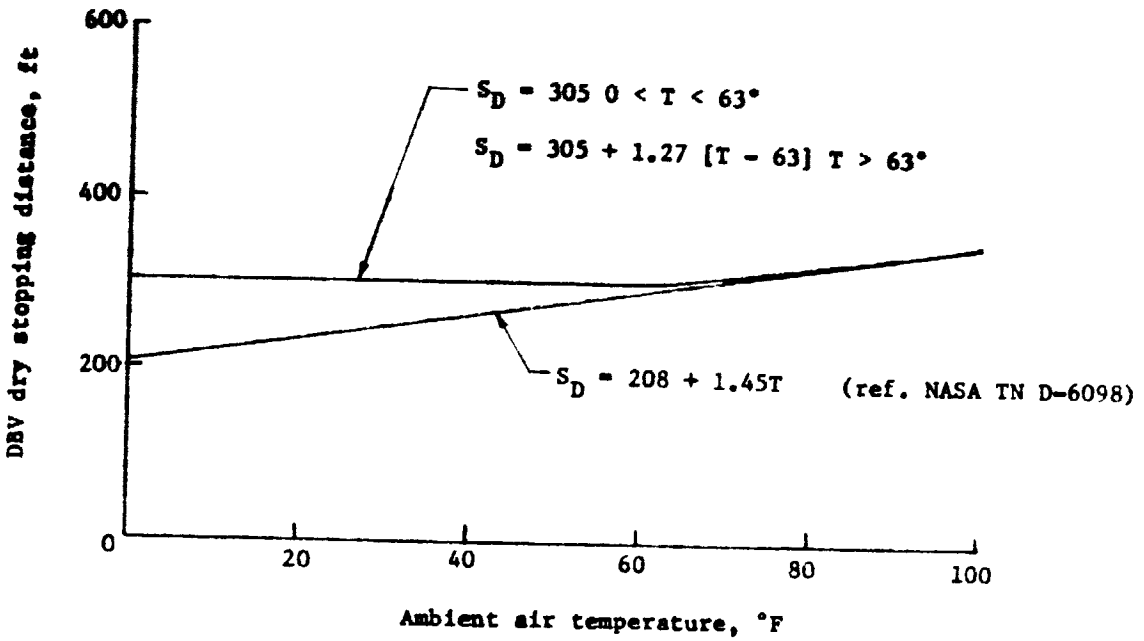


Figure 34.- Comparison of old and new criteria for fairing DBV dry stopping distance values with ambient air temperature.

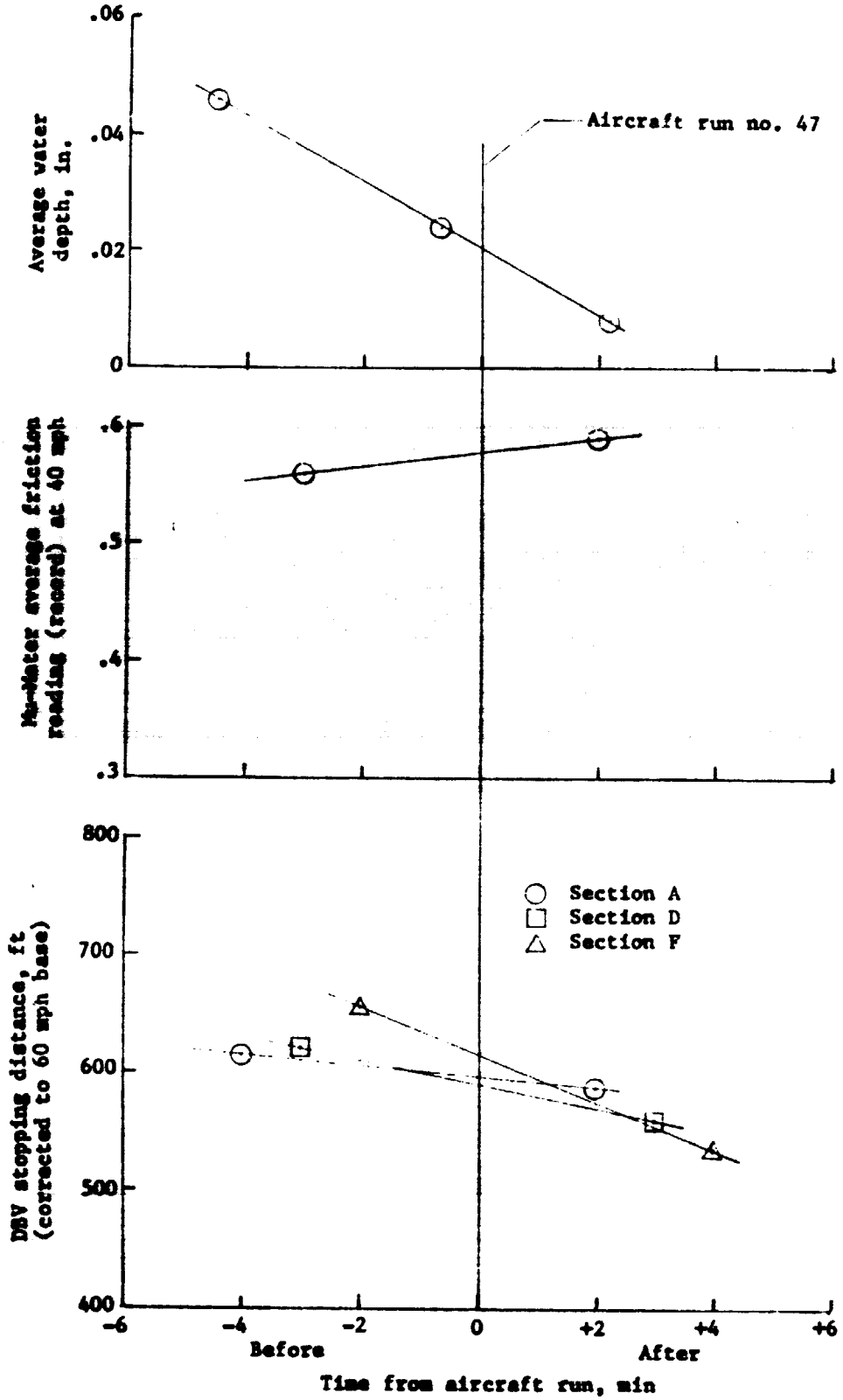


Figure 35.- Example of method used to time correlate water depth, Mu-Meter friction reading, and DBV stopping distance measurements with time of aircraft test run on a wet runway. Run no. 47 at Lubbock.

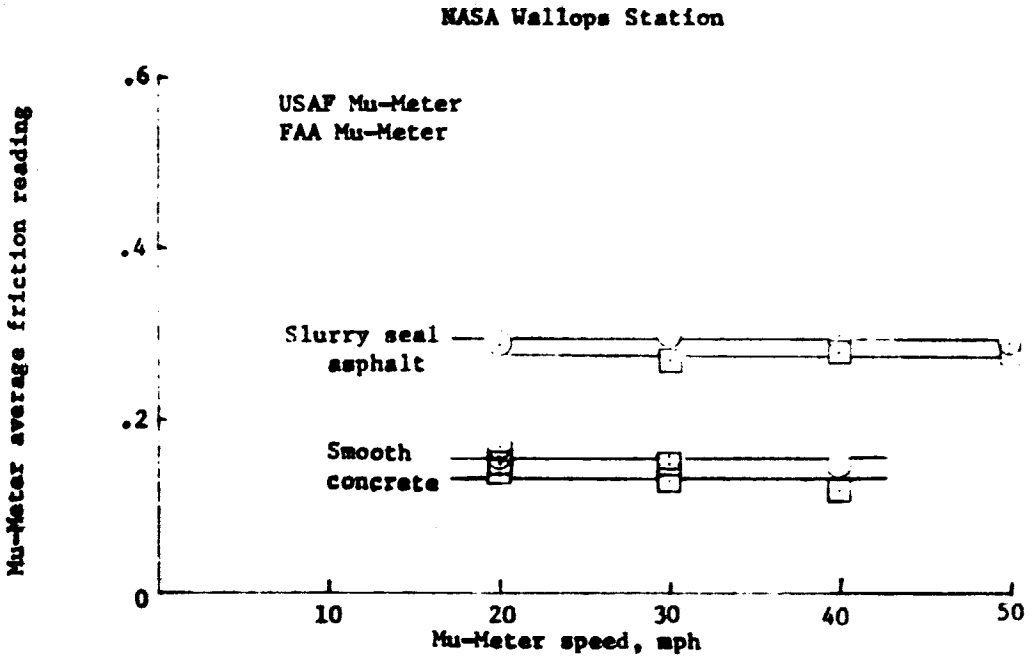
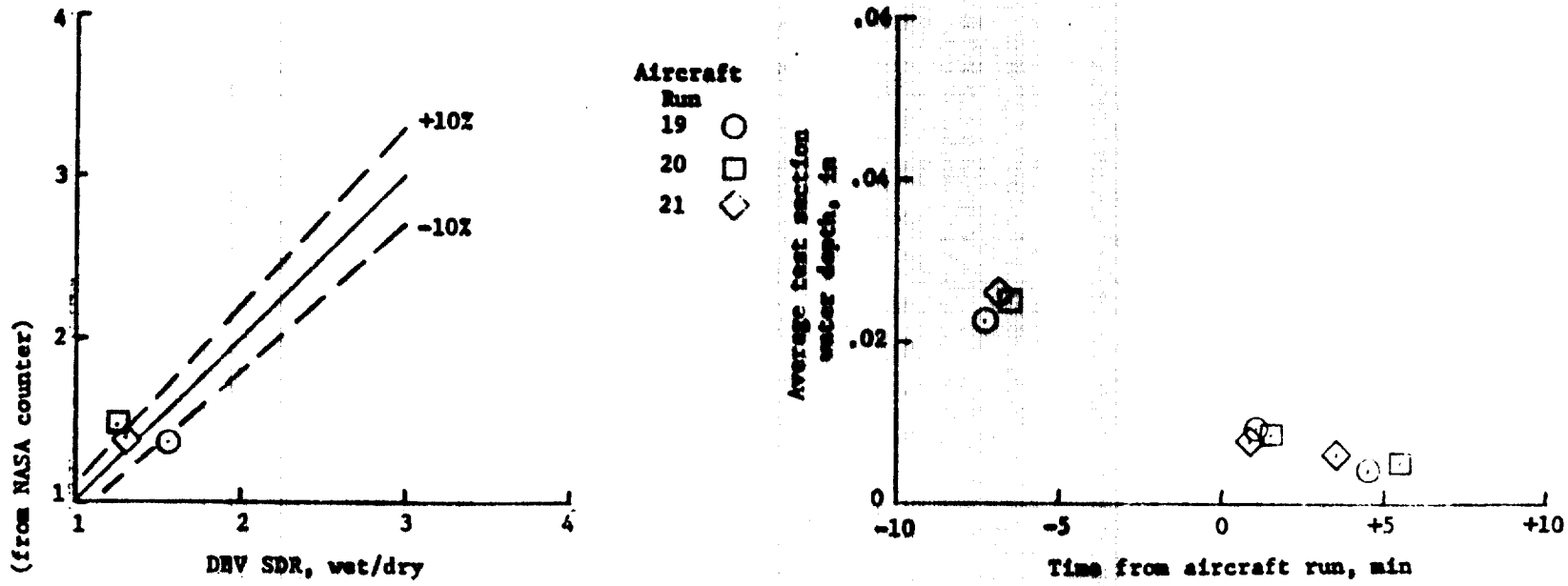
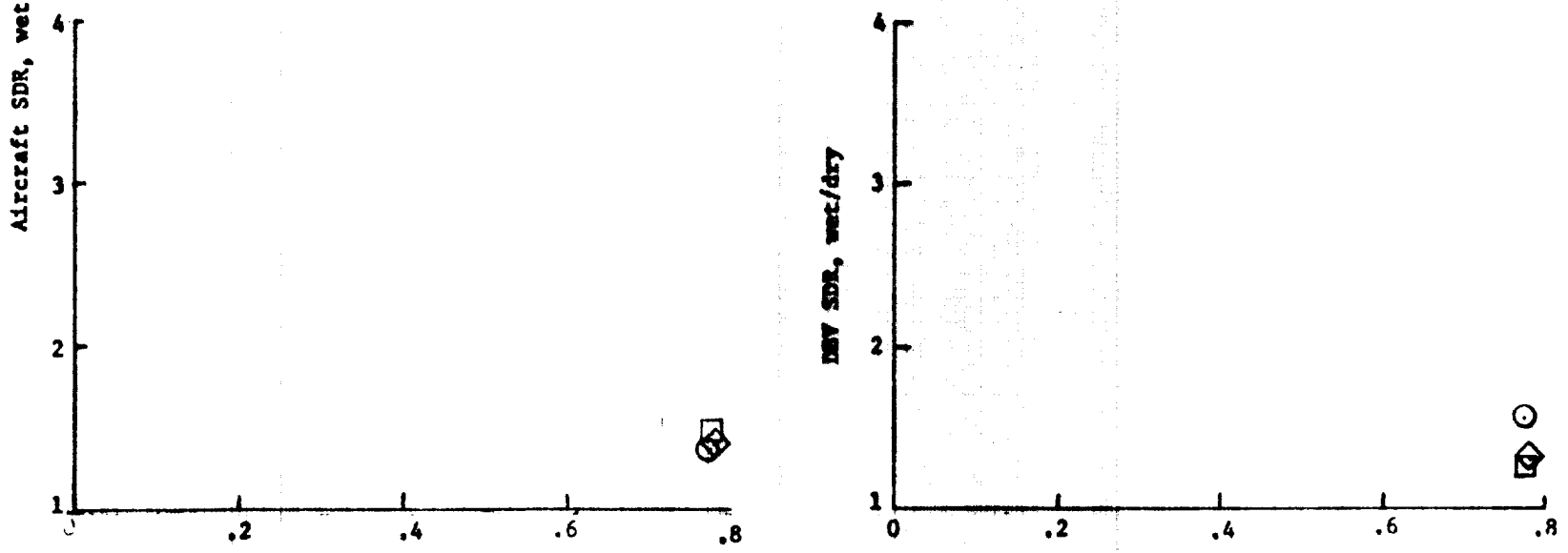


Figure 36.- Variation of Mu-Meter friction reading with speed on two surfaces covered with ice.

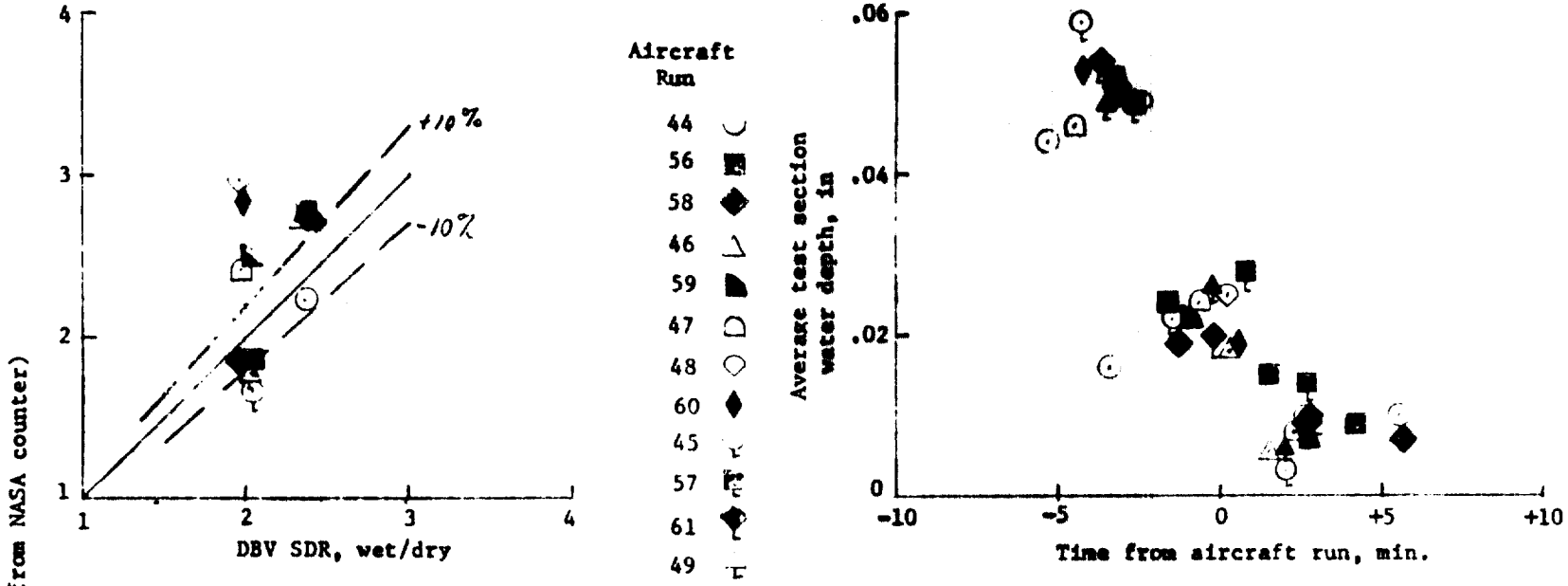


Note: Open symbols - Mark II anti-skid system; closed symbols - Mark IIIA anti-skid system. Tails denote RT runs.

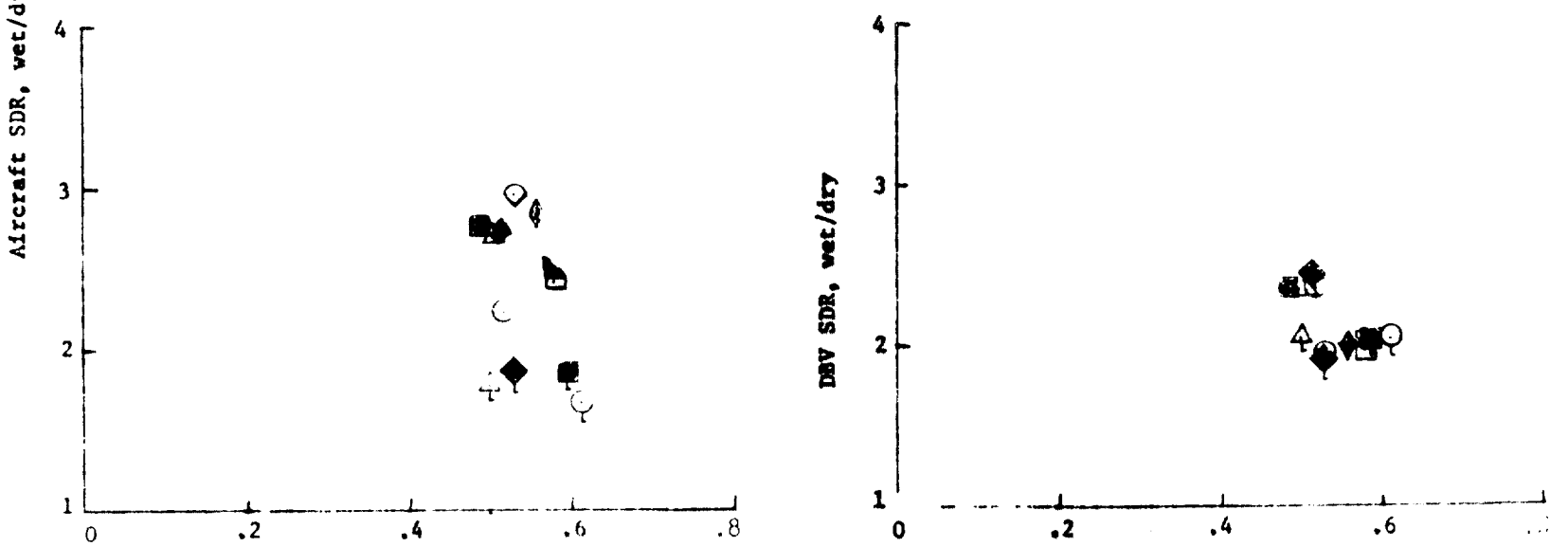


(a) Wallops

Figure 37.- Drainage characteristics and correlation between DC-9 aircraft, NASA DBV, and Mu-Meter stopping or friction performance on wet or snow-covered test runway surface.

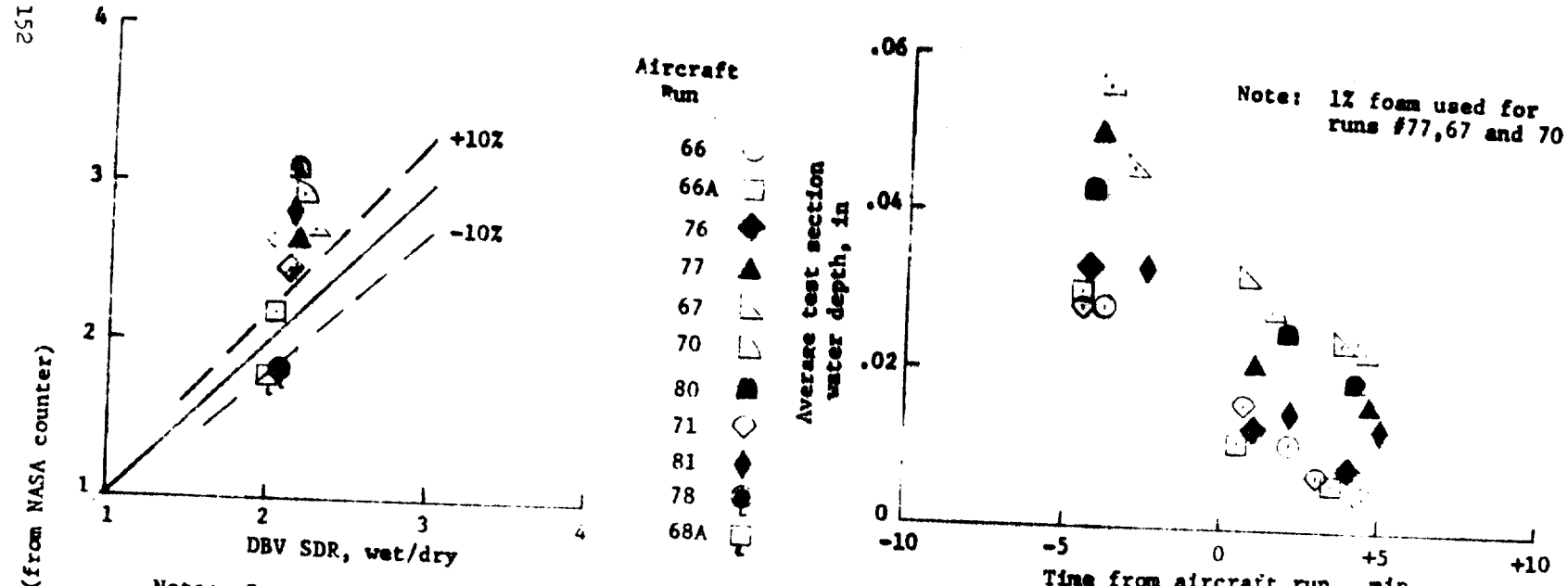


Note: Open symbols - Mark II anti-skid system; closed symbols - Mark IIIA anti-skid system. Tails denote RT runs.

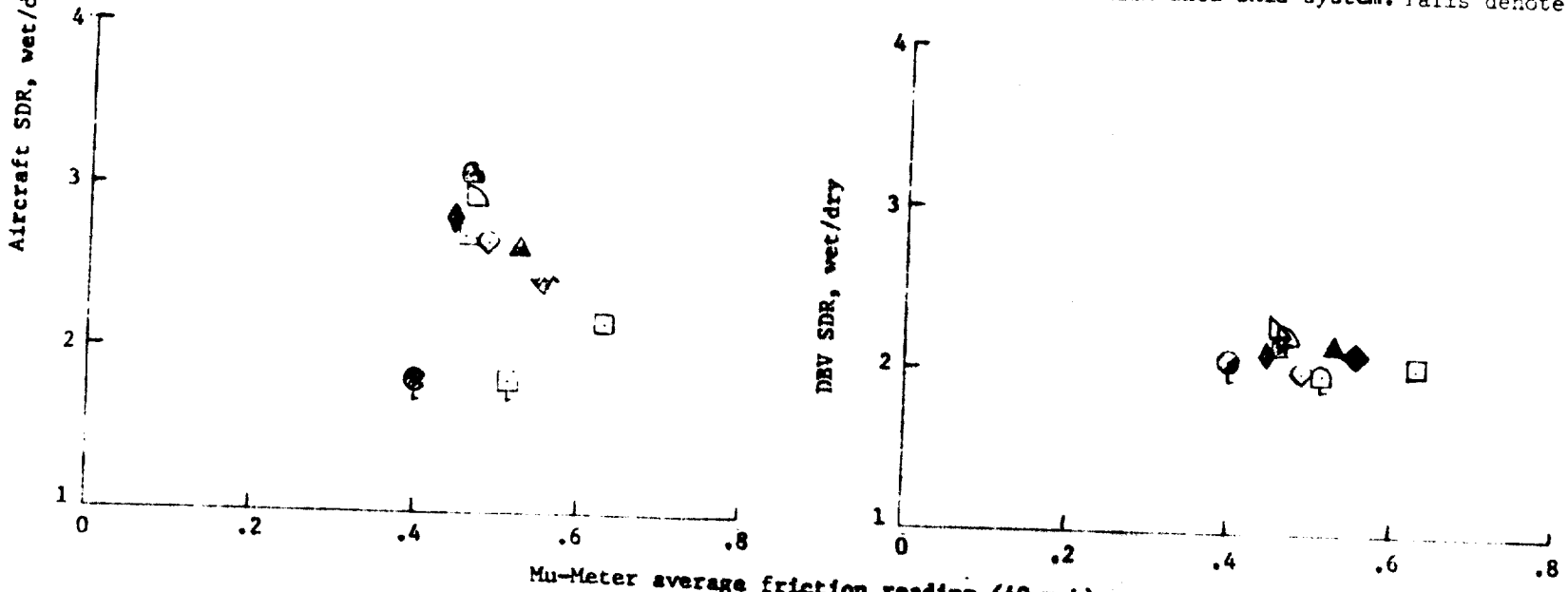


(b) Lubbock

Figure 37.- Continued.

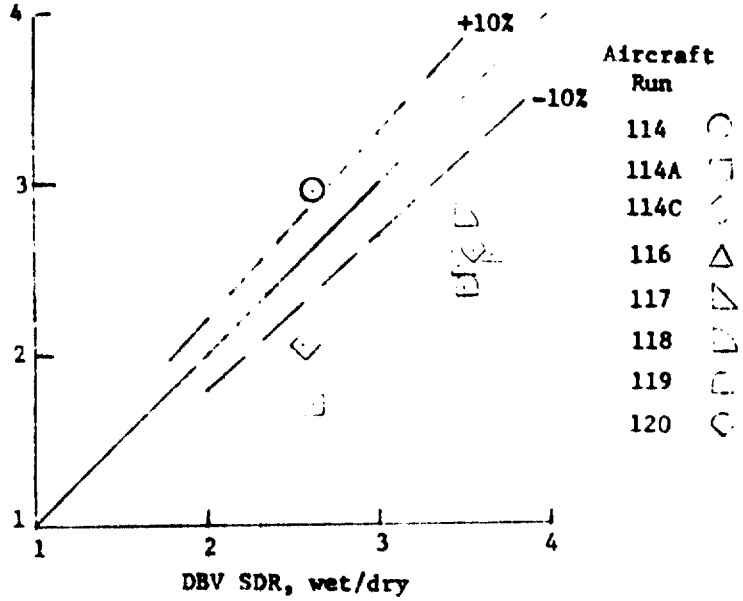


Note: Open symbols - Mark II anti-skid system; closed symbols - Mark IIIA anti-skid system. Tails denote RT runs.



(c) Edwards

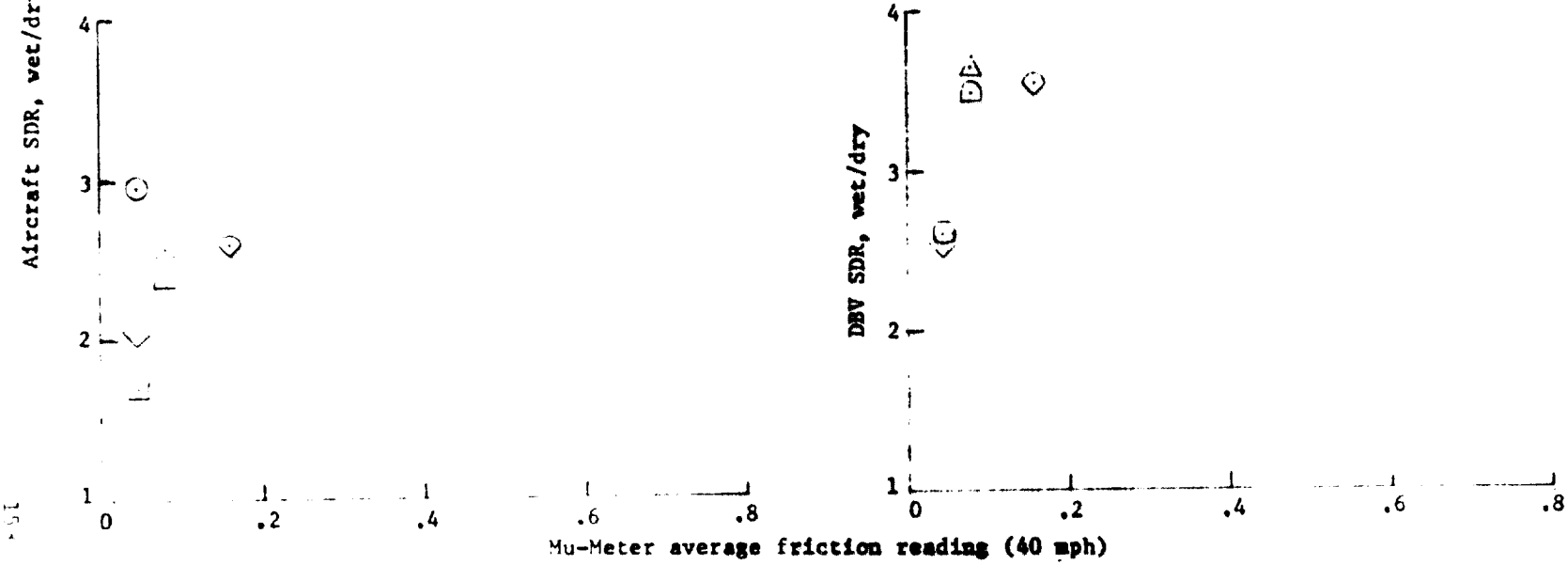
Figure 37.- Continued.



For runs #114, 114A, and 114C, snow test condition of 1 - 2 inches in depth was obtained using snow taken from side of runway.

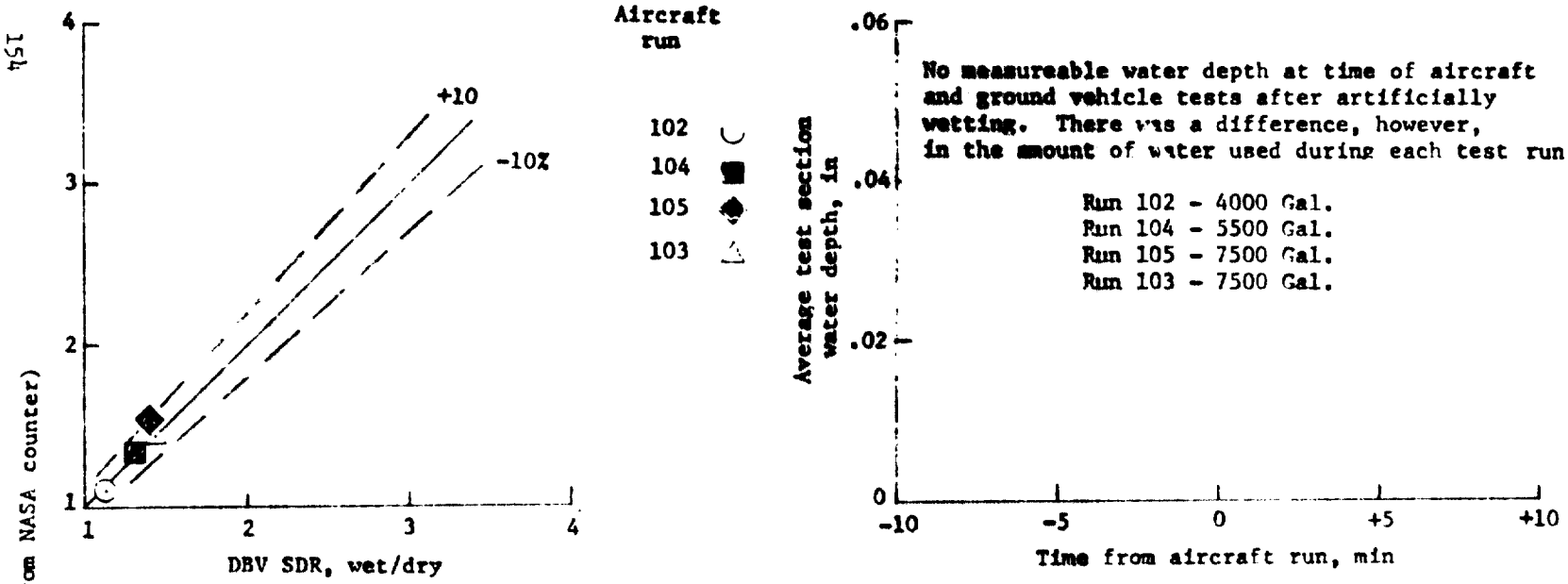
For remaining runs, average snow depth was reduced to 0.3 - 0.4 inches and natural snow was falling during these test runs.

Note: Open symbols - Mark II anti-skid system; closed symbols - Mark IIIA anti-skid system. Tails denote RT runs.

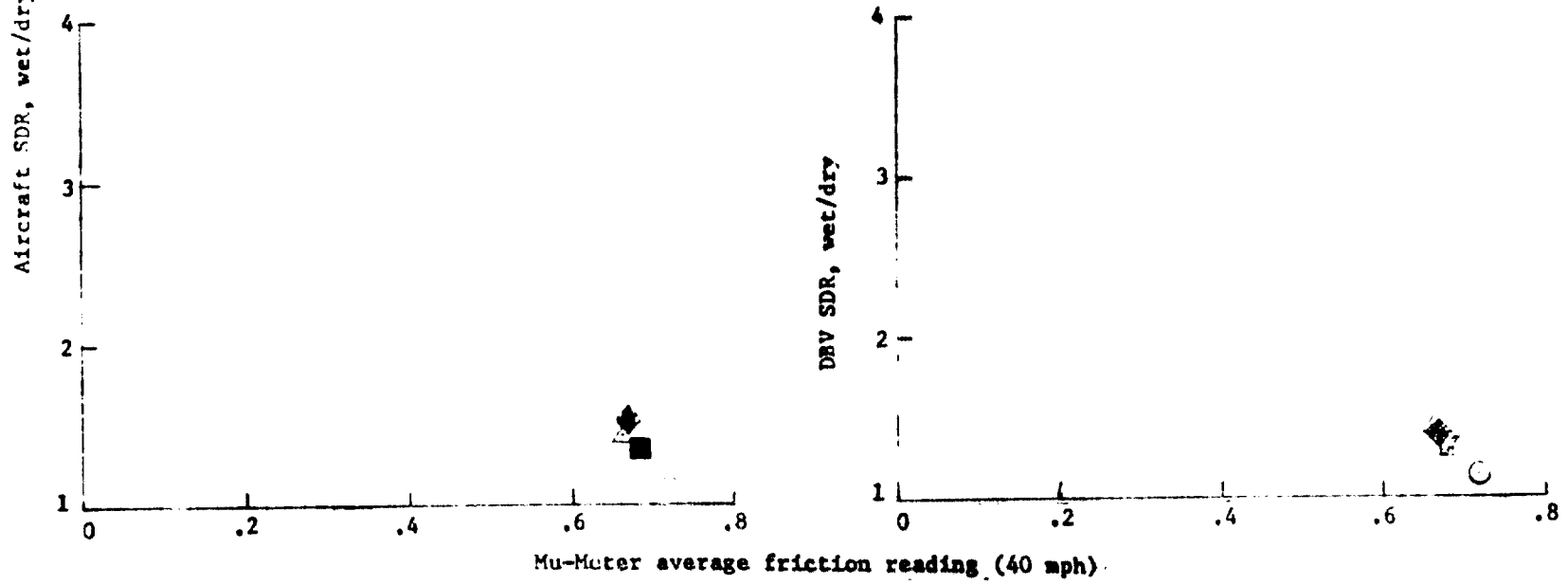


(d) Edmonton

Figure 37.- Continued.



Note: Open symbols - Mark II anti-skid system; closed symbols - Mark IIIA anti-skid system. Tails denote RT runs.



(e) Houston

Figure 37.- Concluded.

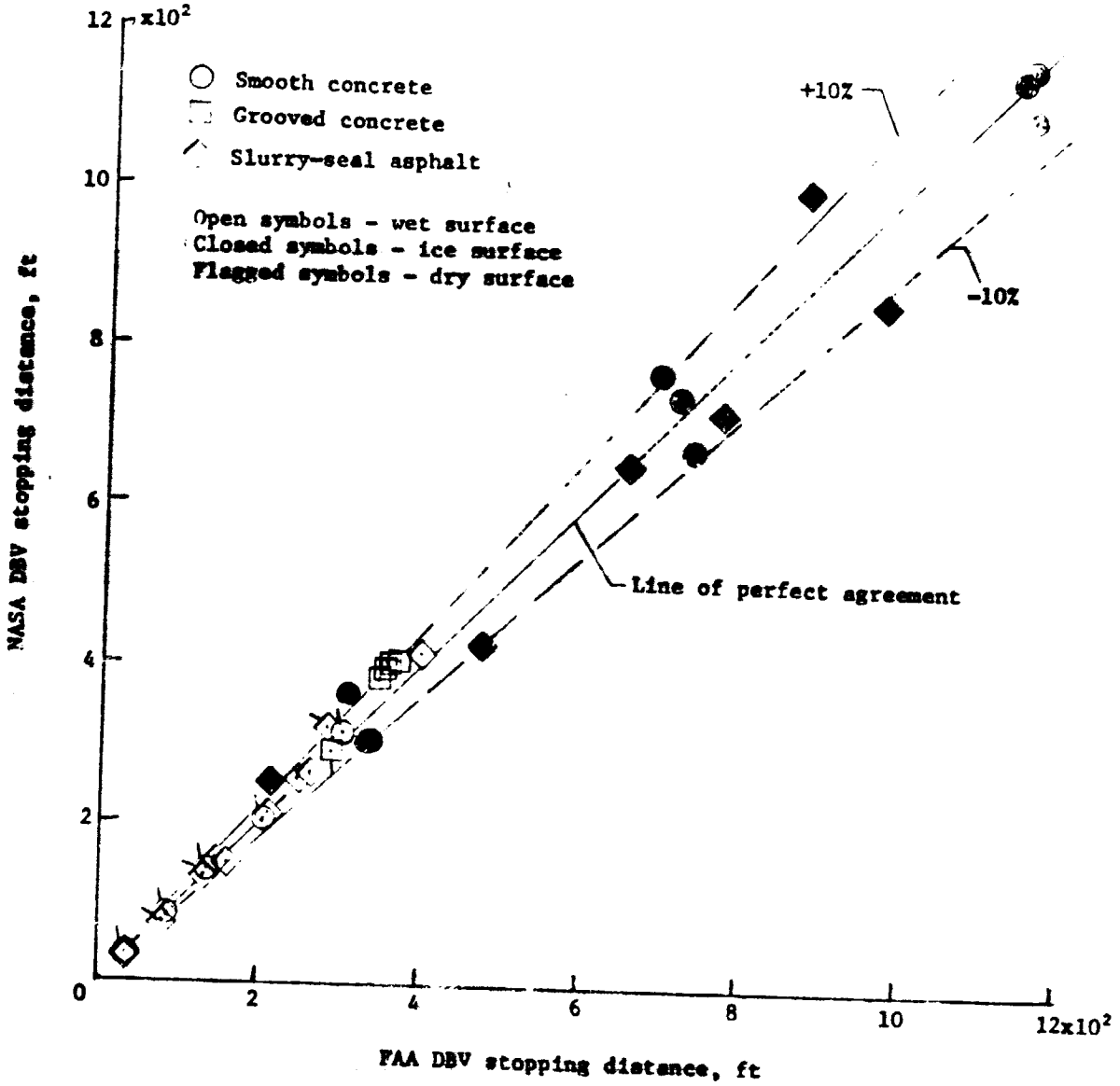


Figure 38.- Comparison of NASA and FAA stopping distance measurements on dry, wet and ice-covered runway surfaces.

Slurry seal - runway 10/28
Ungrooved concrete - runway 4/22
Grooved concrete - runway 4/22

Note: Open symbols denote wet surface
Closed symbols denote ice-covered surface
Flagged symbols denote dry surface

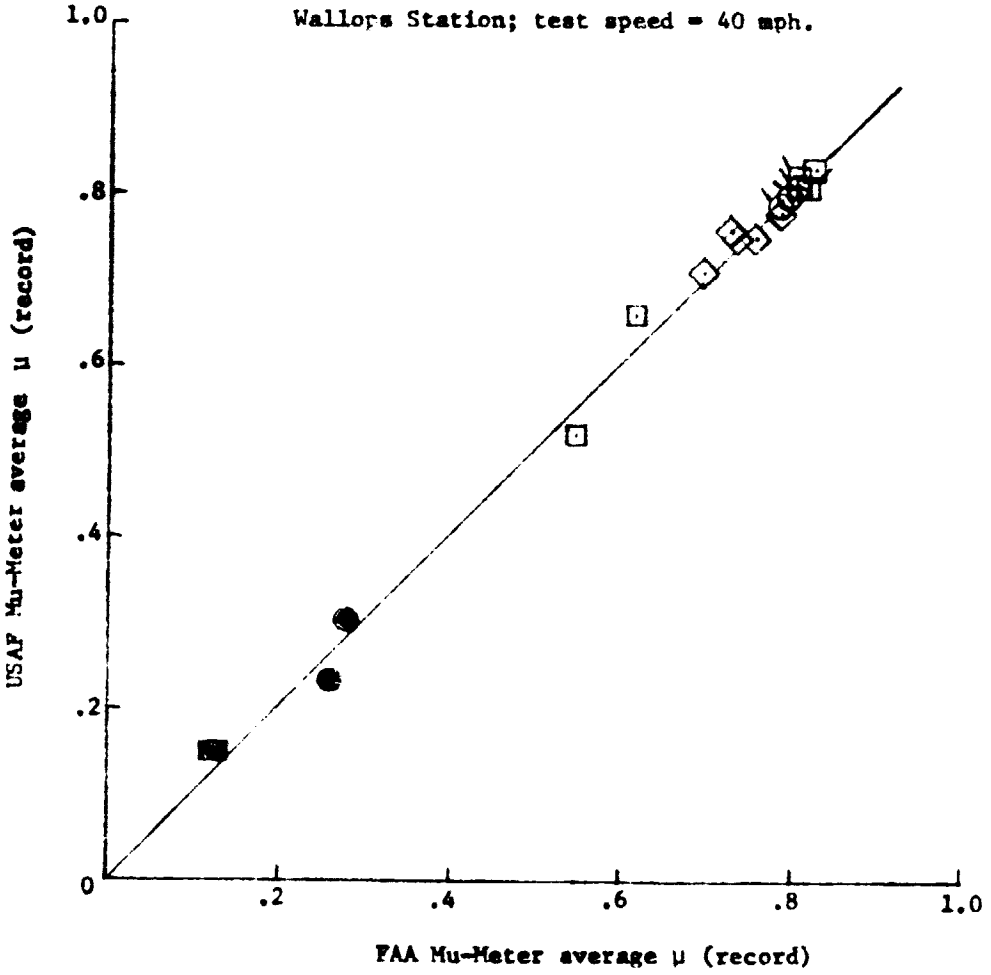


Figure 39.- Correlation between FAA and USAF Mu-Meter data.

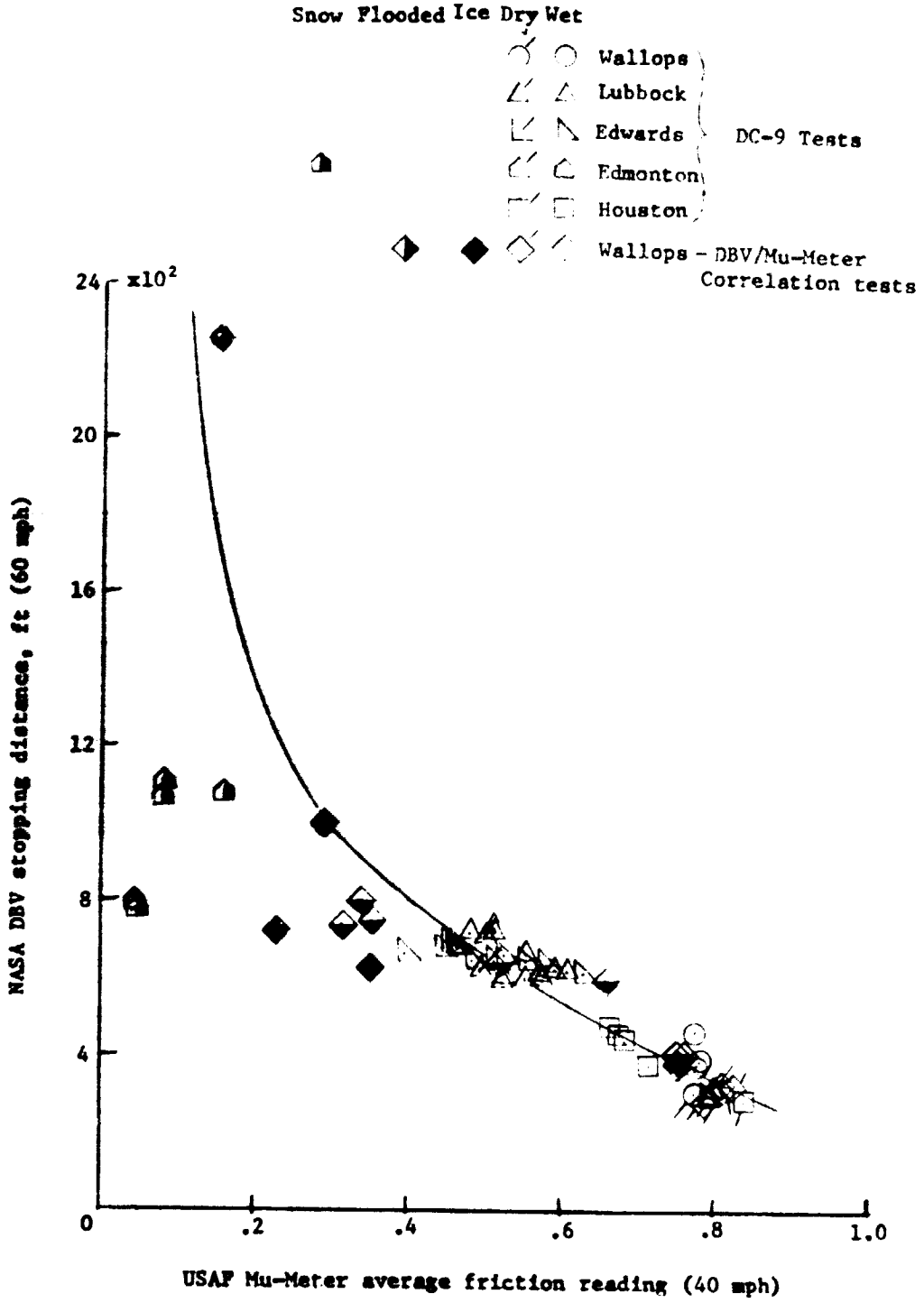


Figure 40.- Comparison of DBV stopping distance and Mu-Meter friction readings obtained on dry, wet, flooded, snow and ice-covered runway surfaces.

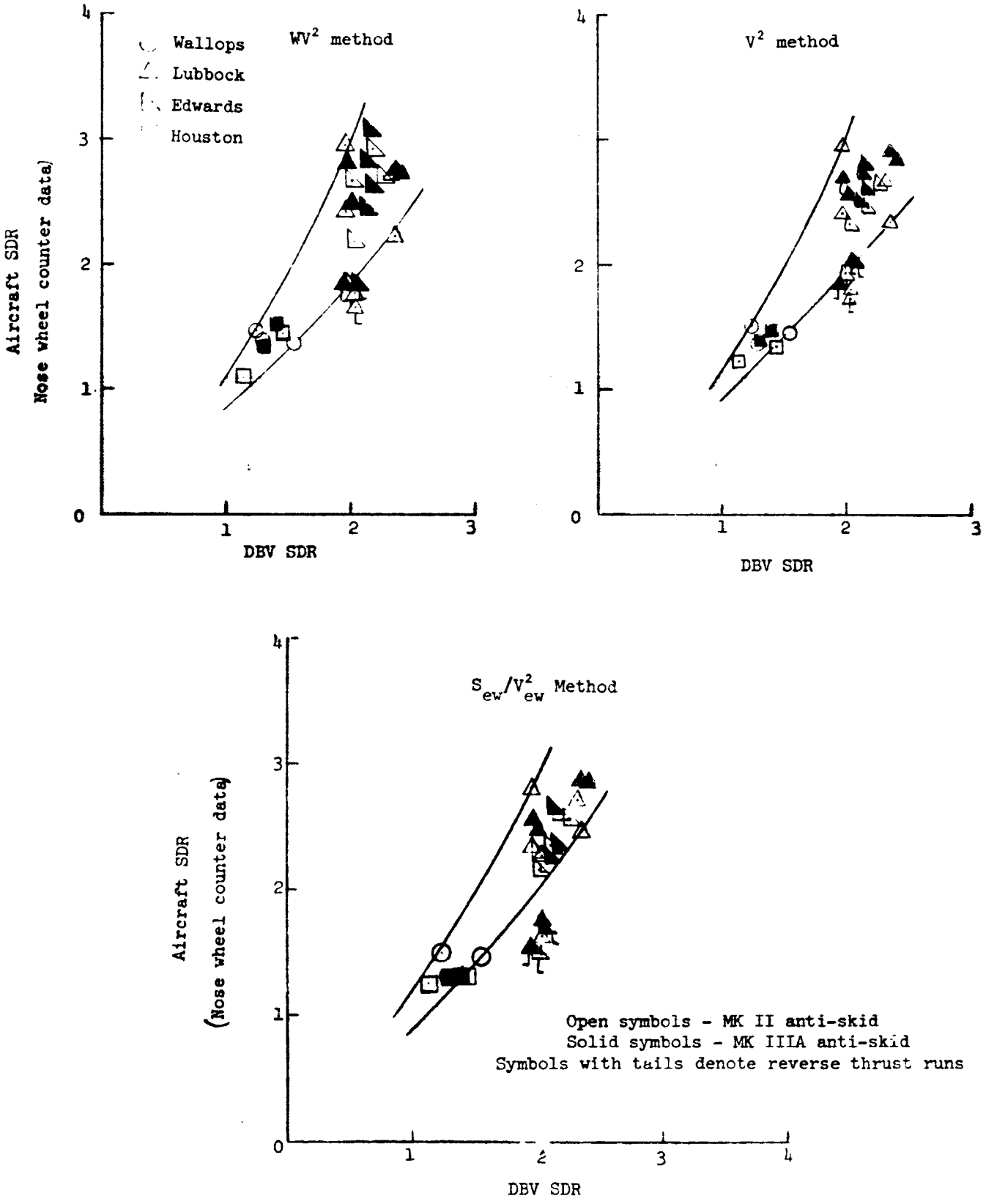


Figure 41.- Variation of DC-9 aircraft SDR with DBV SDR for the wet runways investigated.

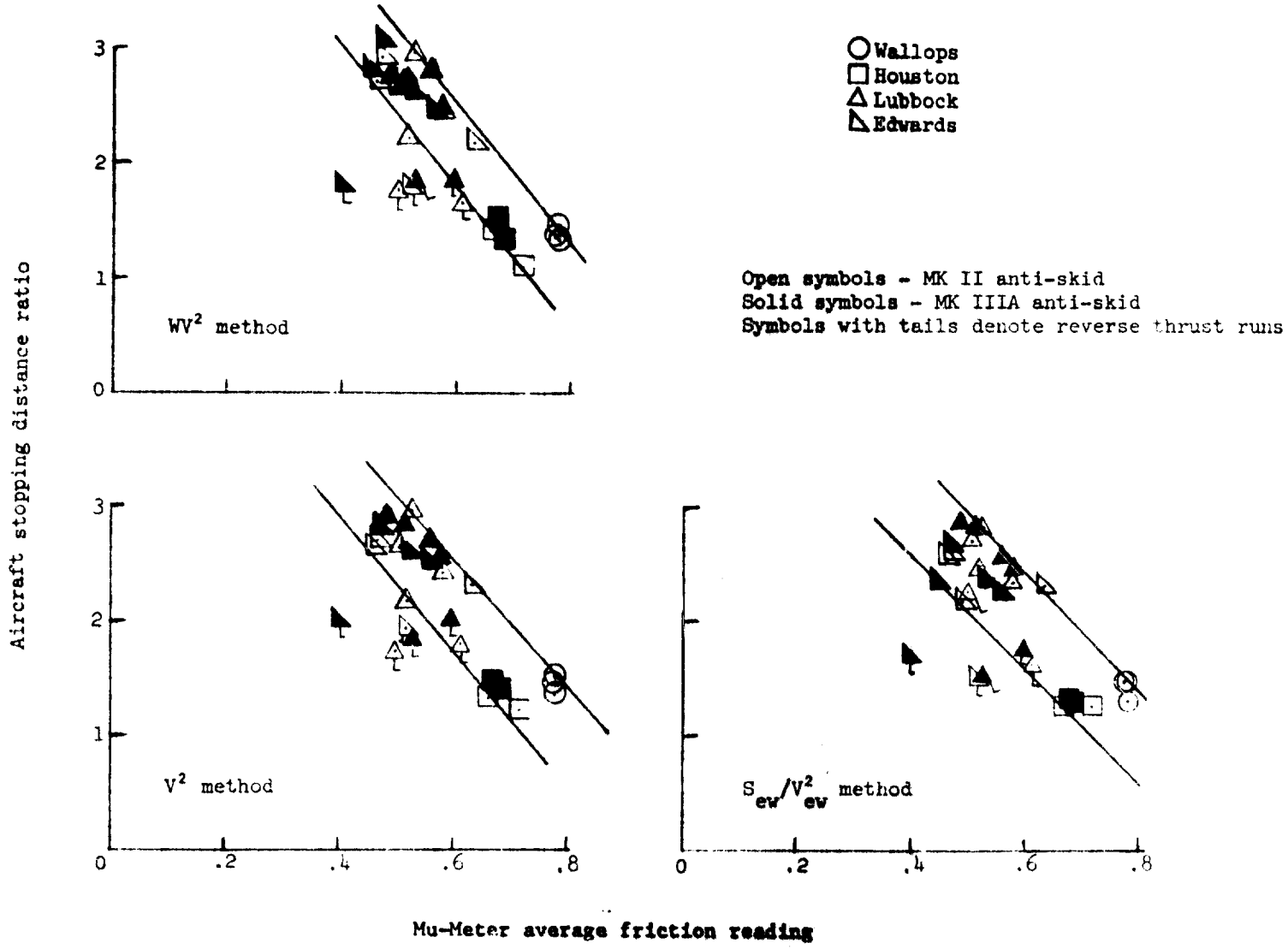


Figure 42.- Variation of aircraft SDR with Mu-Meter average friction reading.

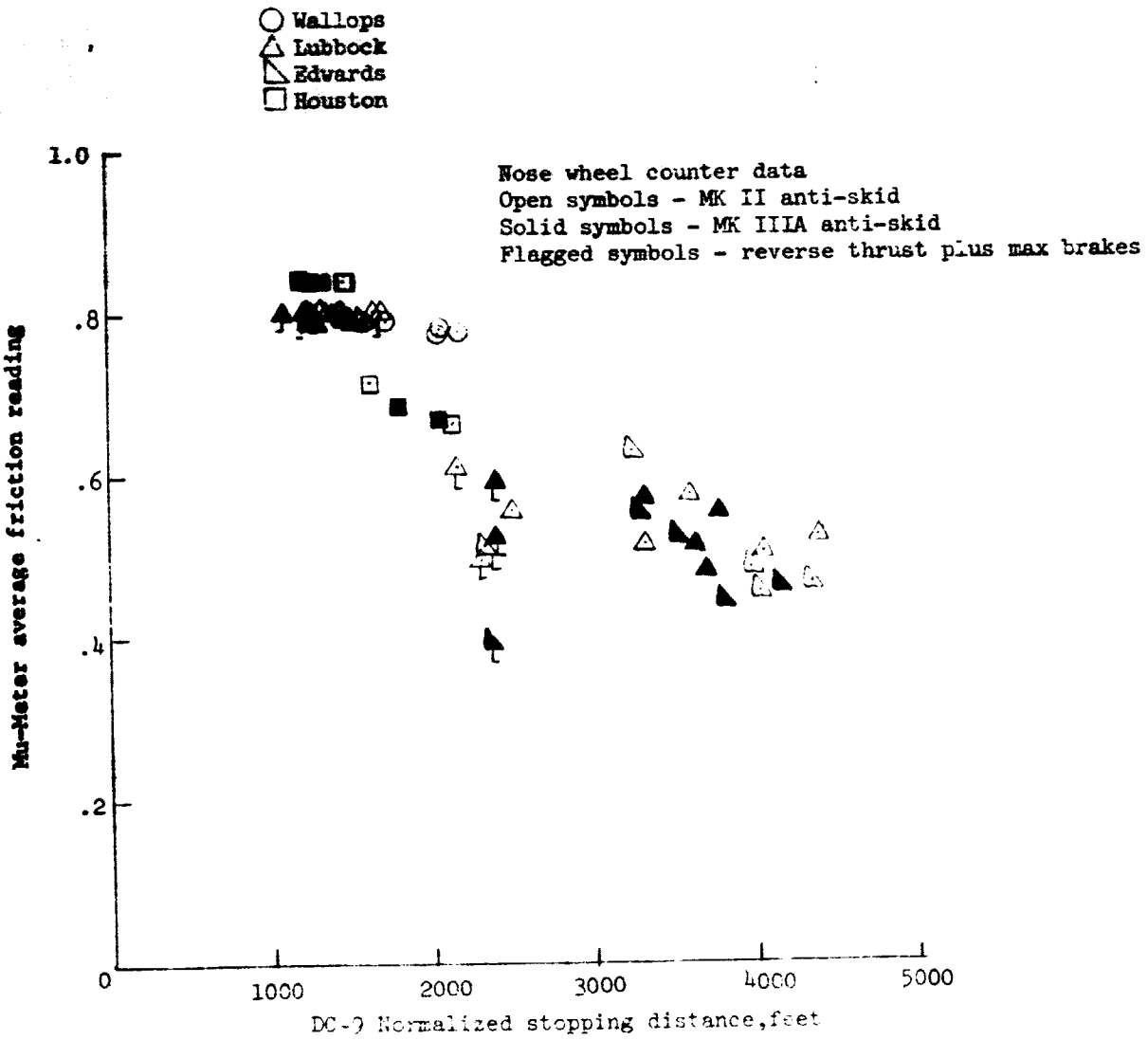


Figure 43.- DC-9 Aircraft stopping distance normalized to $WV^2=10 \times 10^8$ versus mu-meter reading.

Open symbols - MK II anti-skid
Solid symbols - MK IIIA anti-skid
Flagged symbols - reverse thrust plus max brakes

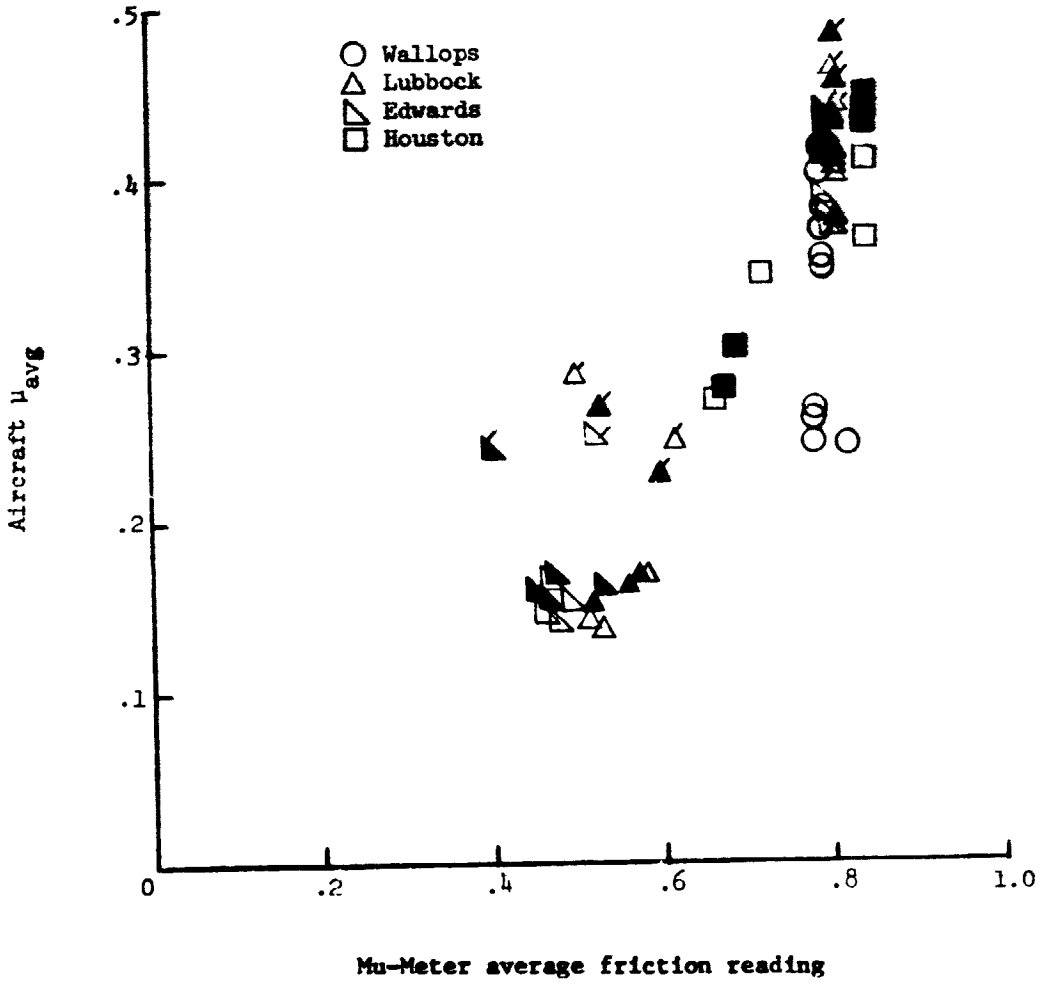


Figure 44.- Comparison of DC-9 average friction coefficient and Mu-Meter average friction reading.

7.0 APPENDIX

7.1 Purpose - Some parameters of significance in analyzing aircraft stopping performance were recorded on the NASA magnetic tape recorder as shown in table III and discussed in paragraph 4.1.10. The purpose of this Appendix is to present these data in the form of time history plots for each aircraft test run. As discussed in paragraph 4.1.10, the magnetic tape data were digitized, converted to engineering units, and machine plotted at the NASA Data Reduction Center.

7.2 Data Presentation - On the facing page for each test run are computed time histories of aircraft longitudinal acceleration, average friction coefficient, and wheel slip ratio. Also presented are the variation of average friction coefficient and slip ratio with ground speed as well as the average friction coefficient variation with wheel slip ratio. The equations required to compute these quantities are described in paragraph 4.1.10 of the report.

7.3 Definitions - The following definitions of terms used in the Appendix may be helpful in interpreting the data presented:

% spoiler	100%, spoiler fully extended; zero %, spoiler retracted
% Engine	Engine 1, left engine; Engine 2, right engine. 100% equals 12,250 rpm of N_2 compressor stage
Pitch attitude	Positive values, pitch-down; negative values, pitch-up
Yaw attitude	Positive values, nose yawed right; negative values, nose yawed left
Normal acceleration (c.g.)	Positive values when aircraft is accelerated in the direction of gravity
Lateral acceleration (c.g.)	Positive values when aircraft accelerates to right
Longitudinal acceleration (c.g.)	Positive values, acceleration; negative values, deceleration
N WH Rev/sec	Angular velocity of right nose wheel
Wheel	1 - Left outboard main wheel 2 - Left inboard main wheel 3 - Right inboard main wheel 4 - Right outboard main wheel

BR psi	Hydraulic pressure measured at wheel brake
BR MTR psi	Hydraulic pressure measured at left hand (left brake pedal) pilot's metering valve
L BR POS	Left brake pedal position (100% equals fully depressed, brakes on)
R BR POS	Right brake pedal position (100% equals fully depressed, brakes on)
2 x N.W REV	One revolution of right nose wheel equals 2 pulses. Computer nose wheel counter resets at zero after 50 nose wheel revolutions (99 pulses)
Average friction coefficient	**Average friction coefficient developed through aircraft anti-skid braking system**

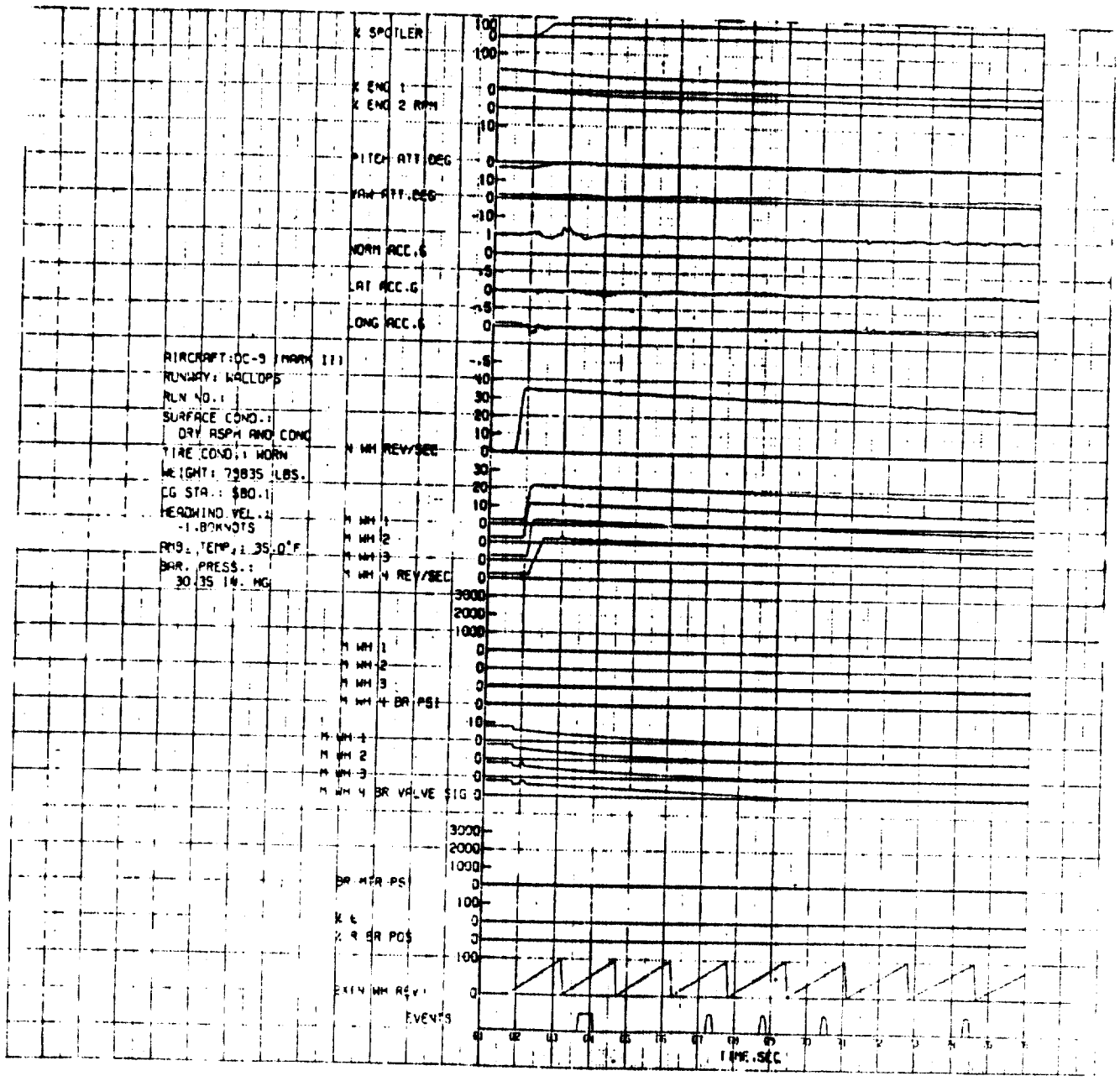
The data presented in the Appendix have not been corrected for instrument zero shift errors. Those cases in which errors occur are obvious and must be considered when analyzing the data.

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AIRPORT	RUN NO.	ANTI-SKID	PAGE NO.
Wallops	1	None	166-167
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	6A		178-179
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	19		186-187
	20		188-189
	21		190-191
	26	Mk IIIA	192-193
	106	Mk IIIA	194-195
	107	Mk II	196-197
	108	Mk II	198-199
	109	Mk IIIA	200-201
Lubbock	38	Mk II	202-203
	39		204-205
	40		206-207
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	47		220-221
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	49		224-225
	50	Mk IIIA	226-227
	51		228-229
	52		230-231
	53		232-233
	54		234-235
	55		236-237
	56		238-239
	57		240-241
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	59		244-245
	60		246-247
	61		248-249
	110	Mk II	250-251
Edwards	62		252-253
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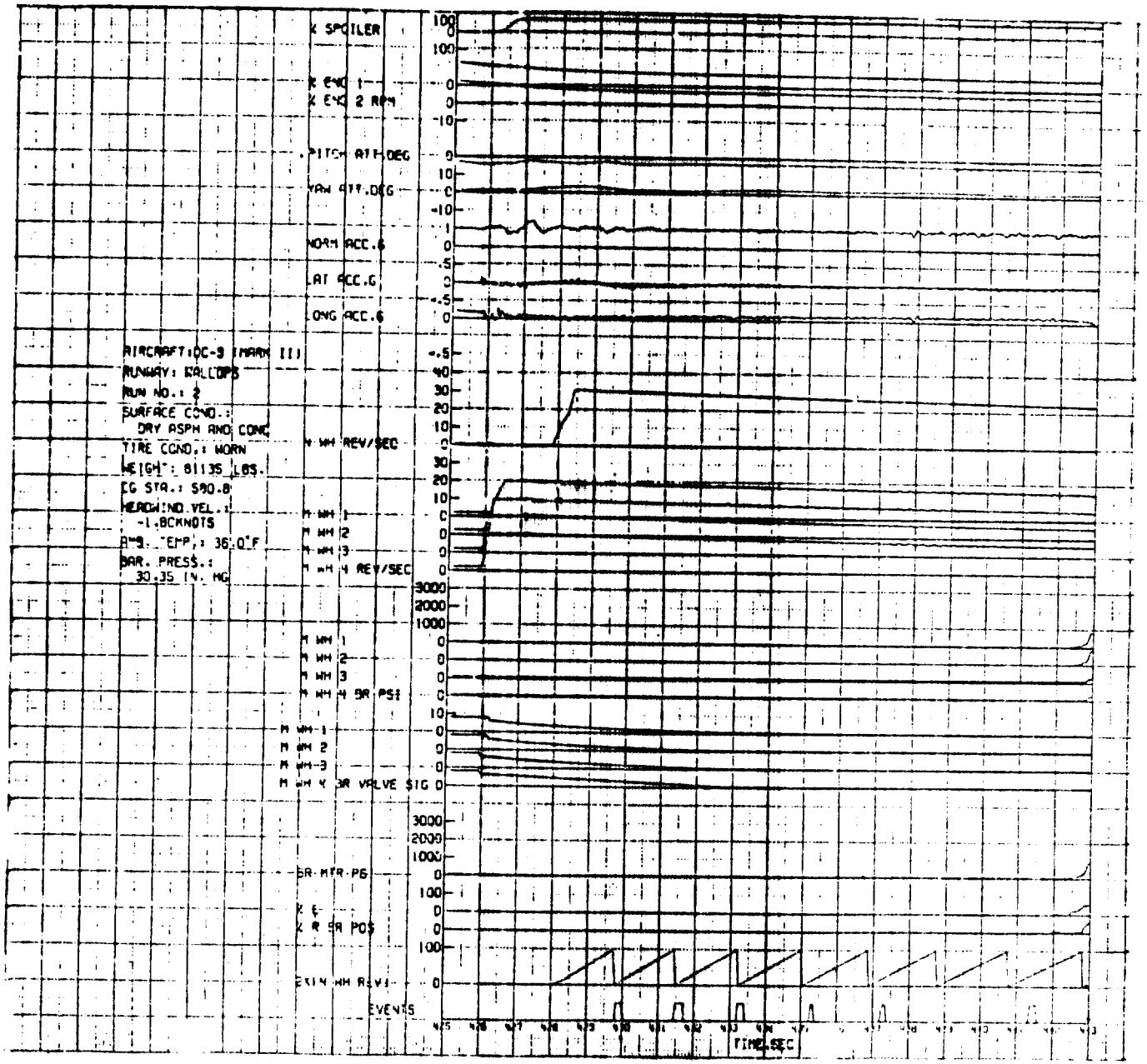
Table of Contents.- Concluded.

AIRPORT	RUN NO.	ANTI-SKID	PAGE NO.
Edwards	65	Mk II	258-259
	66		260-261
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	114B		296-297
	114C		298-299
	115A	None	300-301
	115B	None	302-303
	116	Mk II	304-305
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	118		308-309
	119	Mk IIIA	310-311
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	99	Mk II	316-317
	100	Mk IIIA	318-319
	100A		320-321
	101		322-323
	102	Mk II	324-325
	103	Mk II	326-327
	104	Mk IIIA	328-329
	105	Mk IIIA	330-331


% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (MARK III)
RUNWAY: WACLOPS
RUN NO.:
SURFACE COND.:
DRY ASPH AND CONC
TIRE COND.: WORN
WEIGHT: 79835 LBS.
CG STA.: 880.1
HEADWIND VEL.:
-1.8KNOTS
AMB. TEMP.: 35.0°F
BAR. PRESS.:
30.35 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE SIG
BR MFR PSI
% G
% G BR POS
EVENTS
TIME.SEC

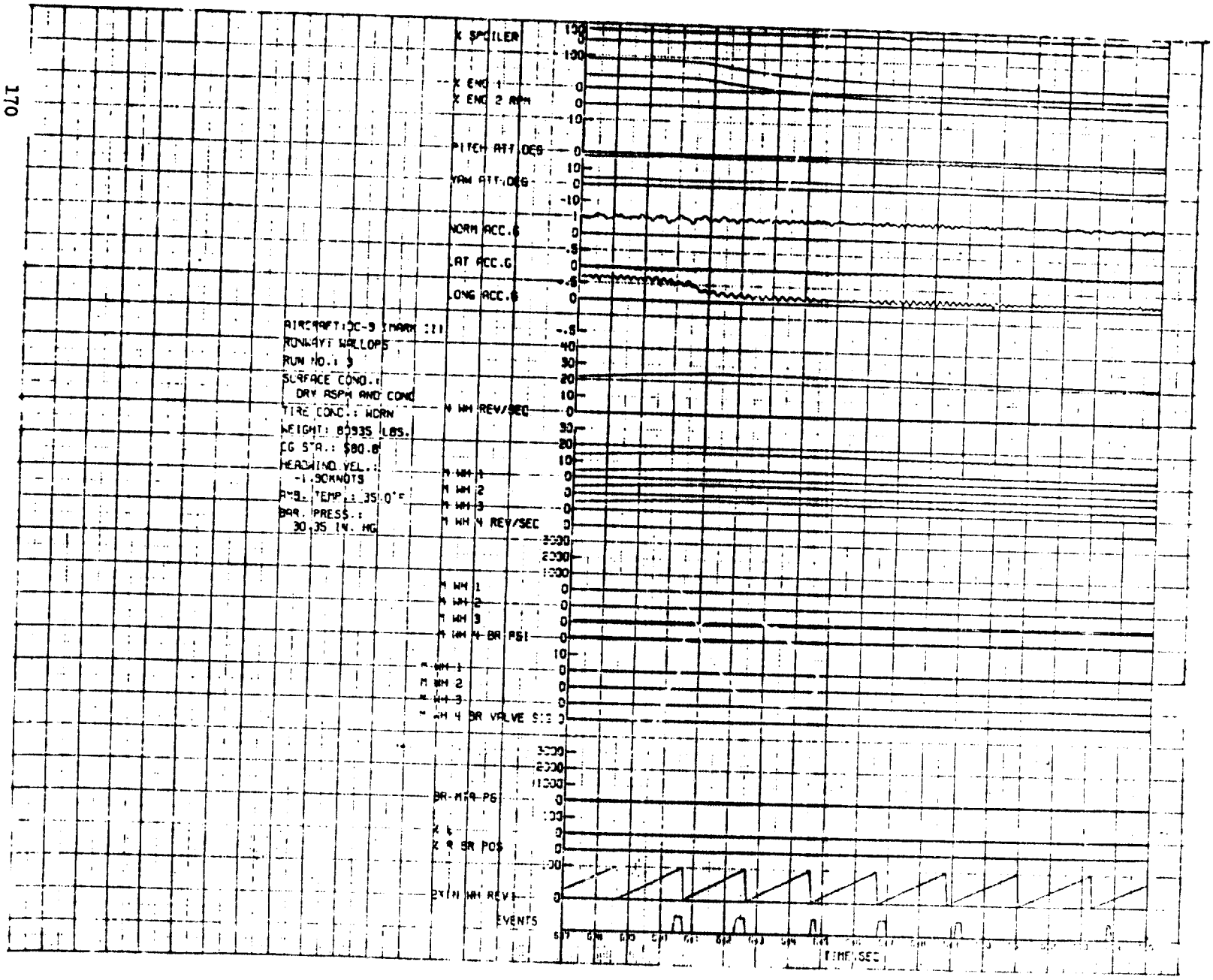
NOT APPLICABLE

(No braking during run)


% SPOILER
% ENG 1
% ENG 2 REV
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:OC-9 (MARK III)
RUNWAY: KALLOPS
RUN NO.: 2
SURFACE COND.:
DRY ASPH AND CONC
TIRE COND.: WORN
WEIGHT: 81135 LBS.
CG STA.: 590.8
HEADWIND VEL.:
-1.8CKNOTS
AMB. TEMP.: 36.0°F
BAR. PRESS.:
30.35 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH-1
N WH 2
N WH-3
N WH 4 BR VALVE SIG
BR MTR PS
% E
% R BR POS
EXIN WH REV
EVENTS
TIME,SEC

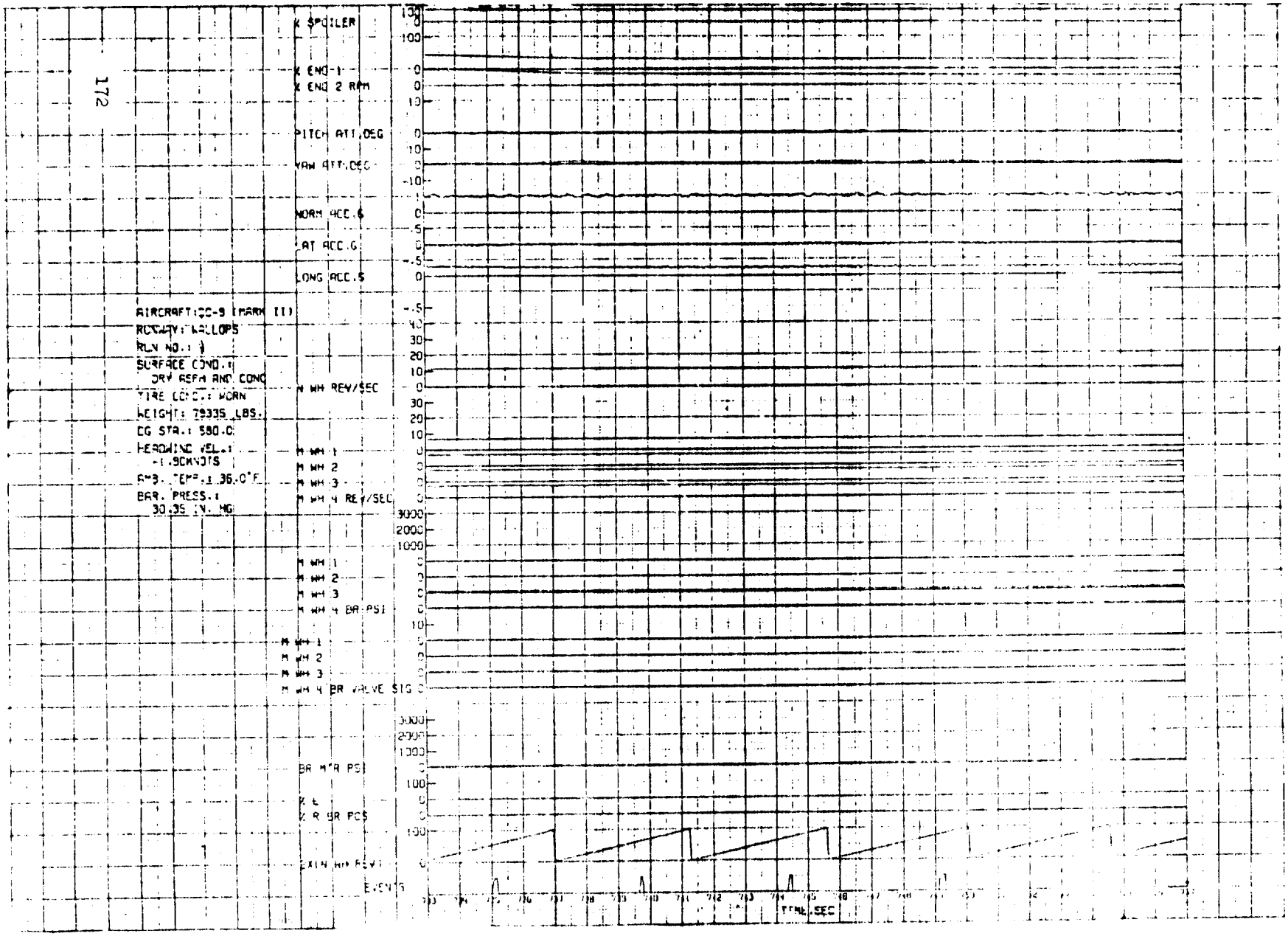
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(No braking during run)


AIRCRAFT: DC-9 (MARK III)
RUNWAY: WALLOPS
RUN NO.: 9
SURFACE COND.:
DRY ASPH AND CONC
TIRE COND.: WORN
WEIGHT: 80935 LBS.
CG STA.: 880.8
HEADWIND VEL.:
-1.9 KNOTS
AMB. TEMP.: 35.0°F
BAR. PRESS.:
30.35 IN. HG
X SPOILER
X END 1
X END 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE SIG
BR-MTR-PS
X 6
X 9 SR POS
SYN WH REV
EVENTS
TIME/SEC

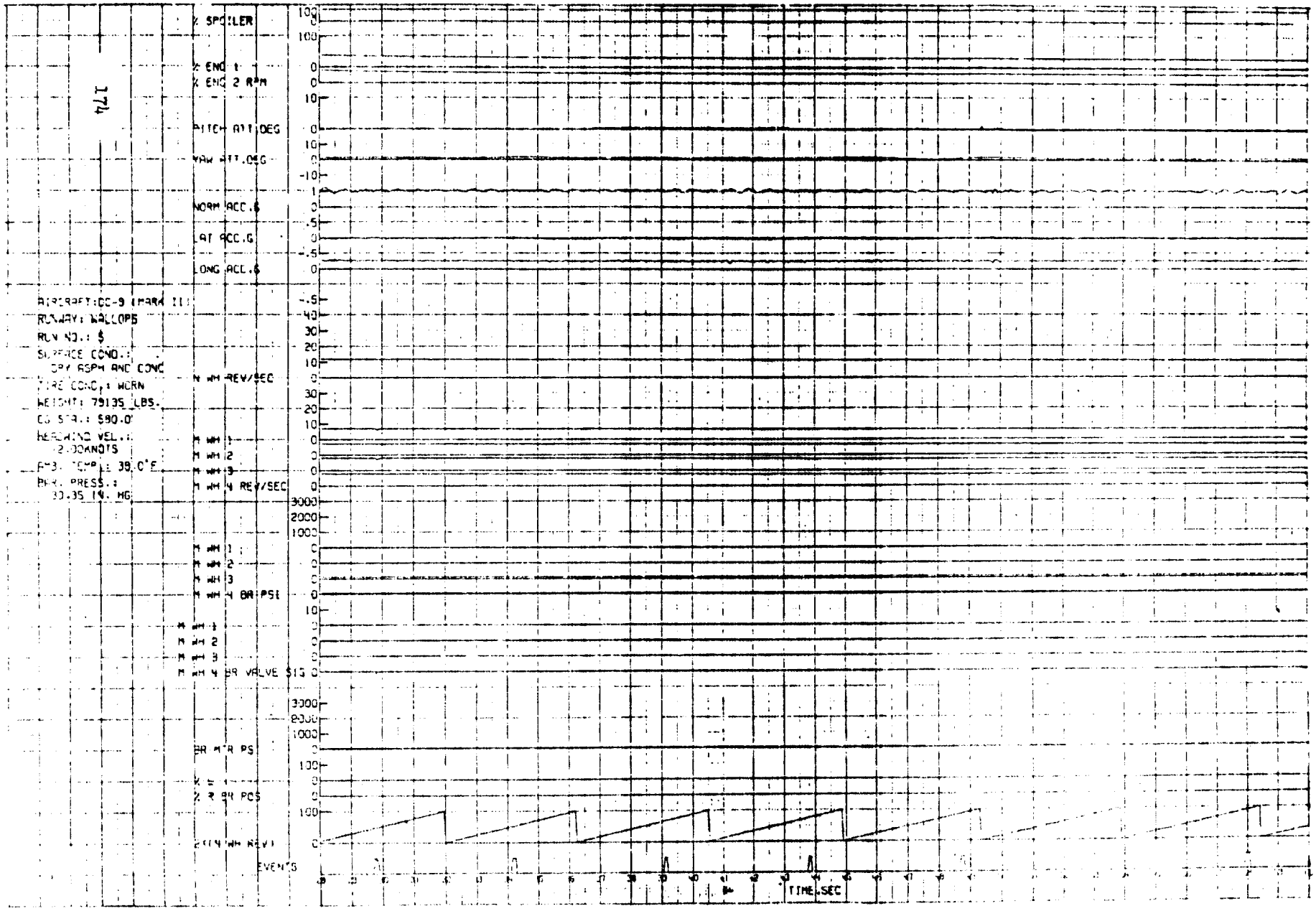
NOT APPLICABLE

(No braking during run)


% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-9 (MARK II)
RCWAY: WALLOPS
RUN NO.: 1
SURFACE COND.:
DRY ASPH AND CONC
TIRE COND.: WORN
WEIGHT: 79335 LBS.
CG STA.: 580.0
HEADWIND VEL.:
-1.9KNOTS
AMB. TEMP.: 36.0°F
BAR. PRESS.:
30.35 IN. HG
WH REV/SEC
WH 1
WH 2
WH 3
WH 4 REV/SEC
WH 1
WH 2
WH 3
WH 4 BR PSI
WH 1
WH 2
WH 3
WH 4 BR VALVE SIG
BR MTR PSI
% L
% R BR PCS
EXIT WH REV
EVENTS
TIME,SEC

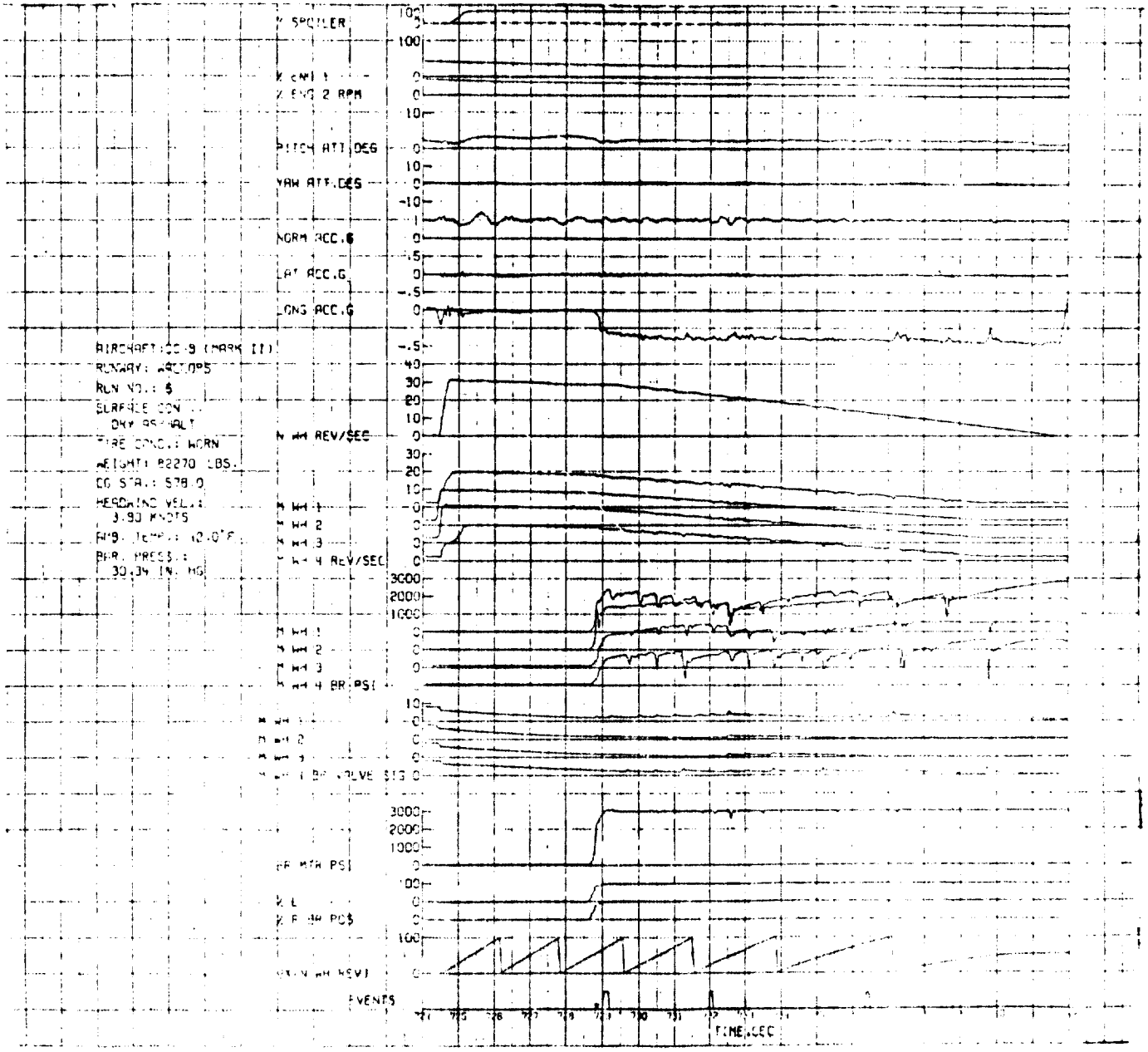
NOT APPLICABLE

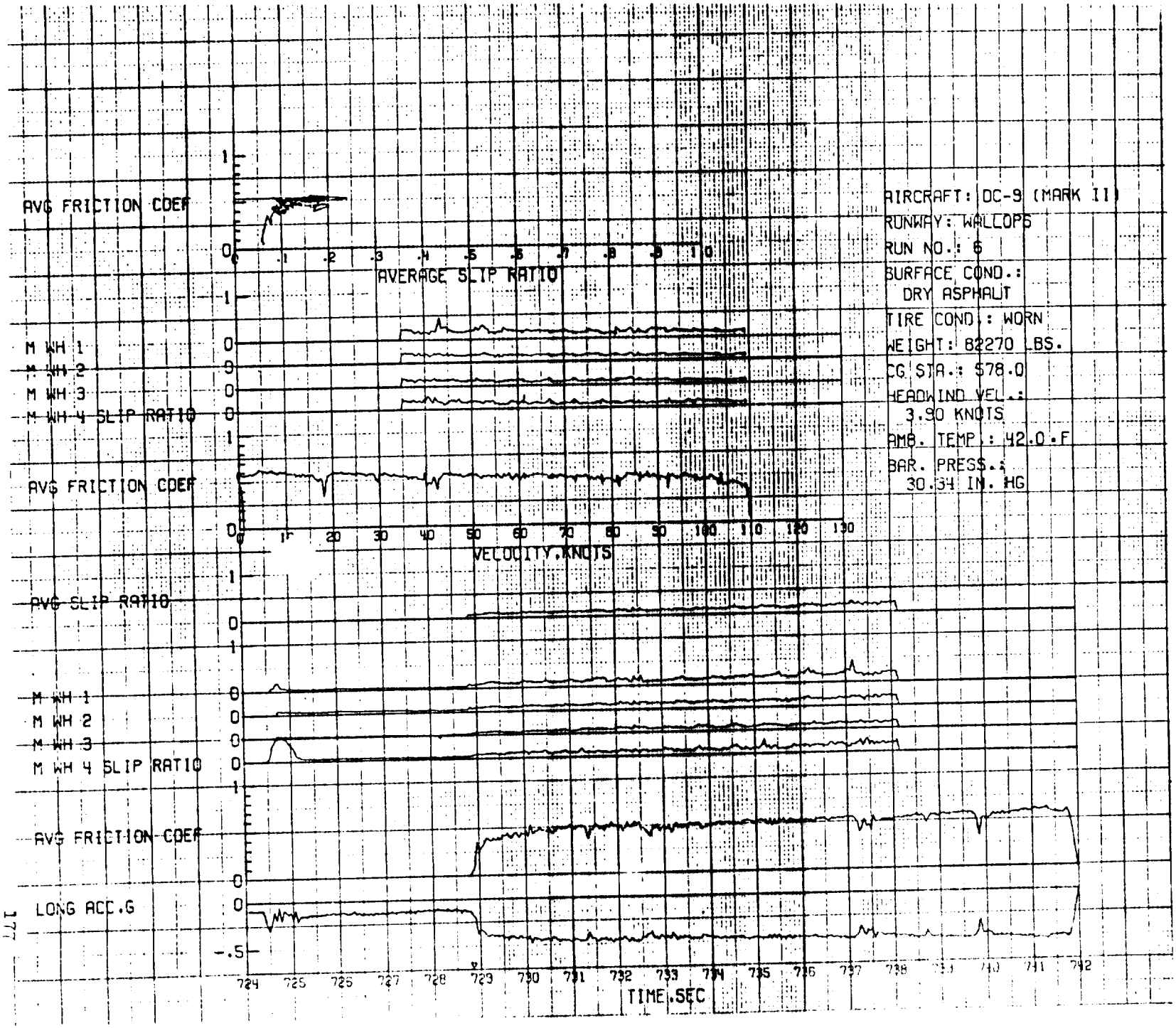
(No braking during run)

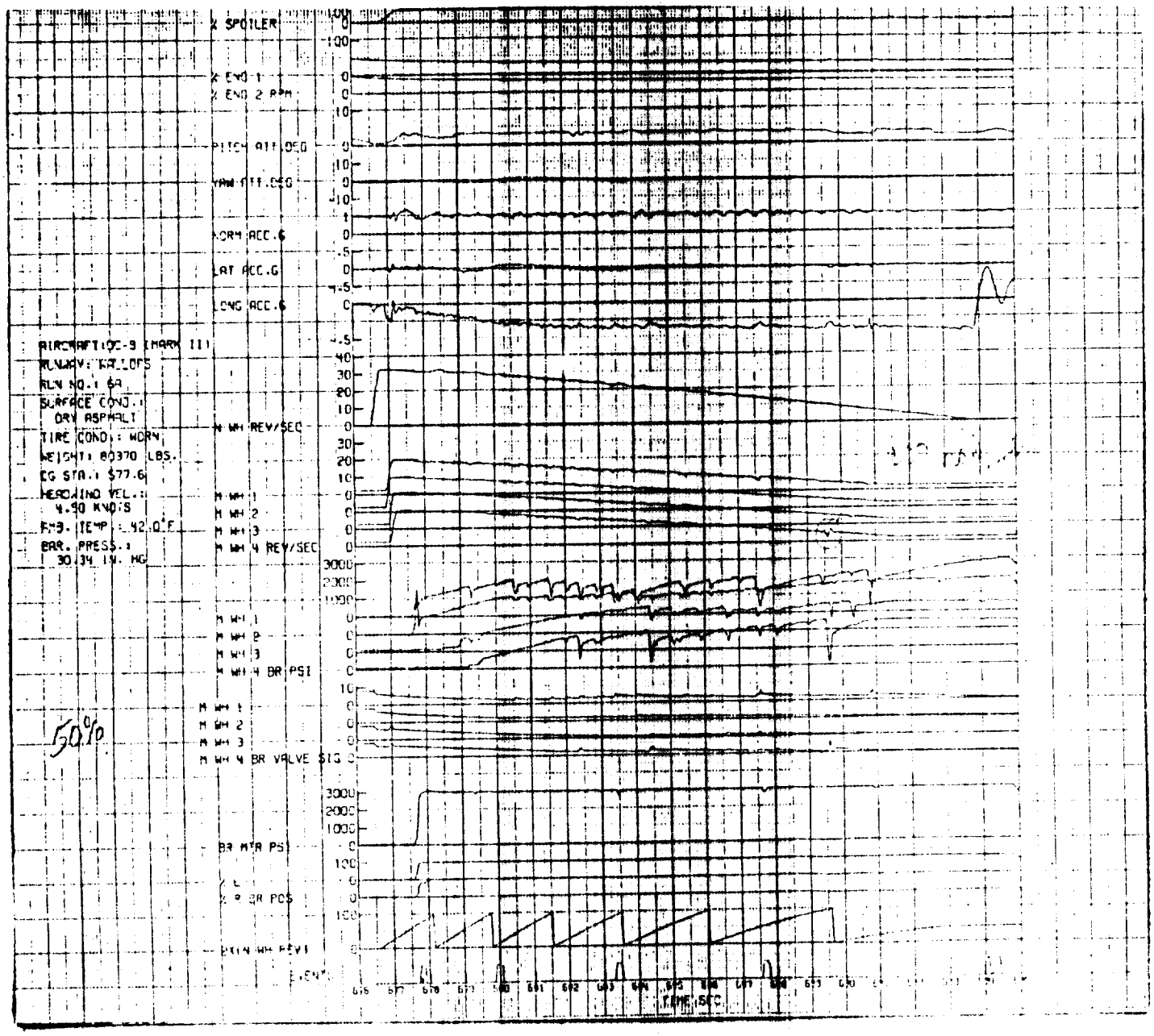

174
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-9 (MARK II)
RUNWAY: WALLOPS
RUN NO.: $
SURFACE COND.:
DRY ASPH AND CONC
TIRE COND.: WORN
WEIGHT: 79135 LBS.
CG STA.: 890.0
HEADWIND VEL.:
2.00KNOTS
AMB. TEMP.: 39.0°F
BAR. PRESS.:
30.35 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE SIG
BR MTR PS
% 1 BR POS
% 2 BR POS
EVENTS
TIME,SEC

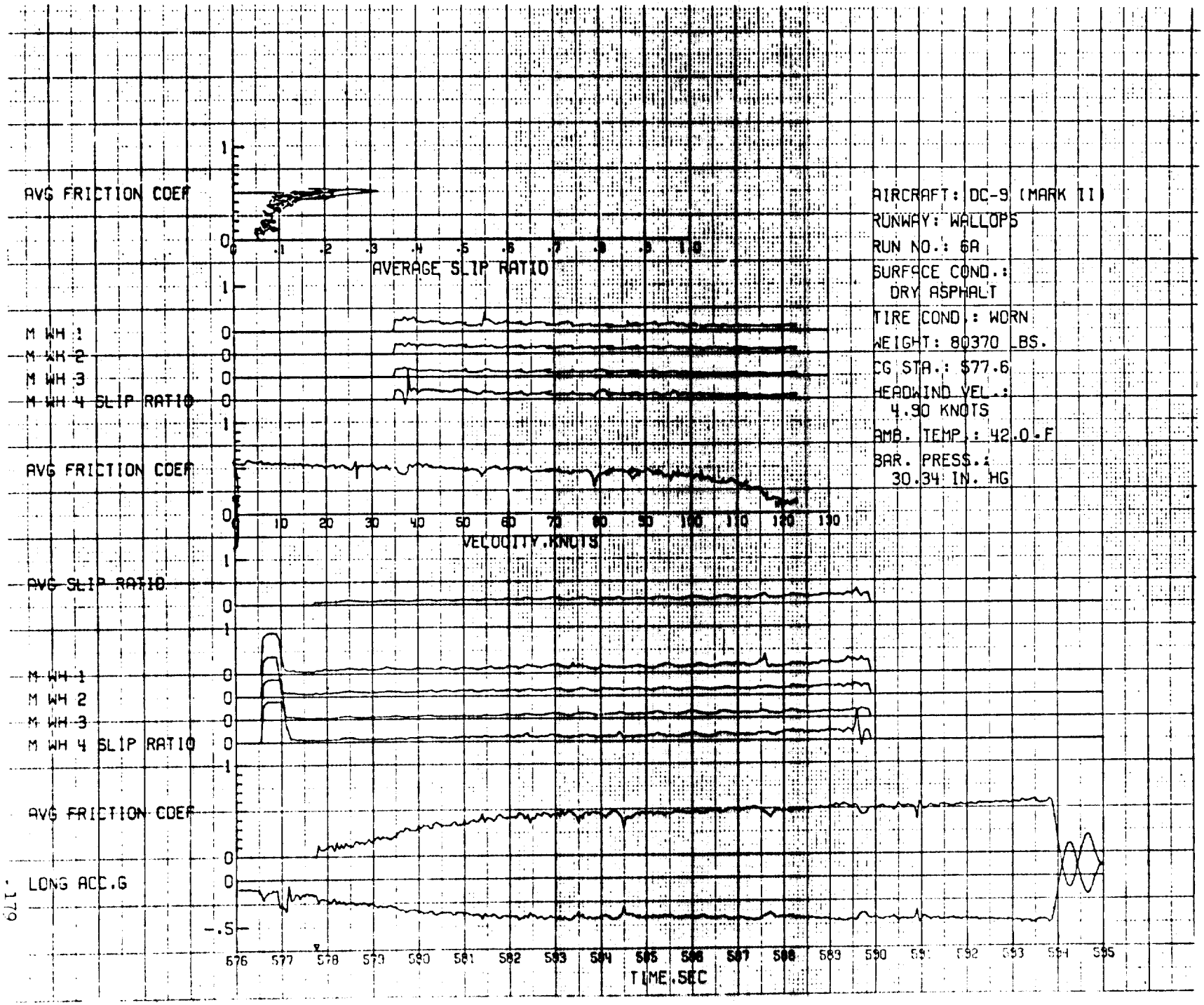
NOT APPLICABLE

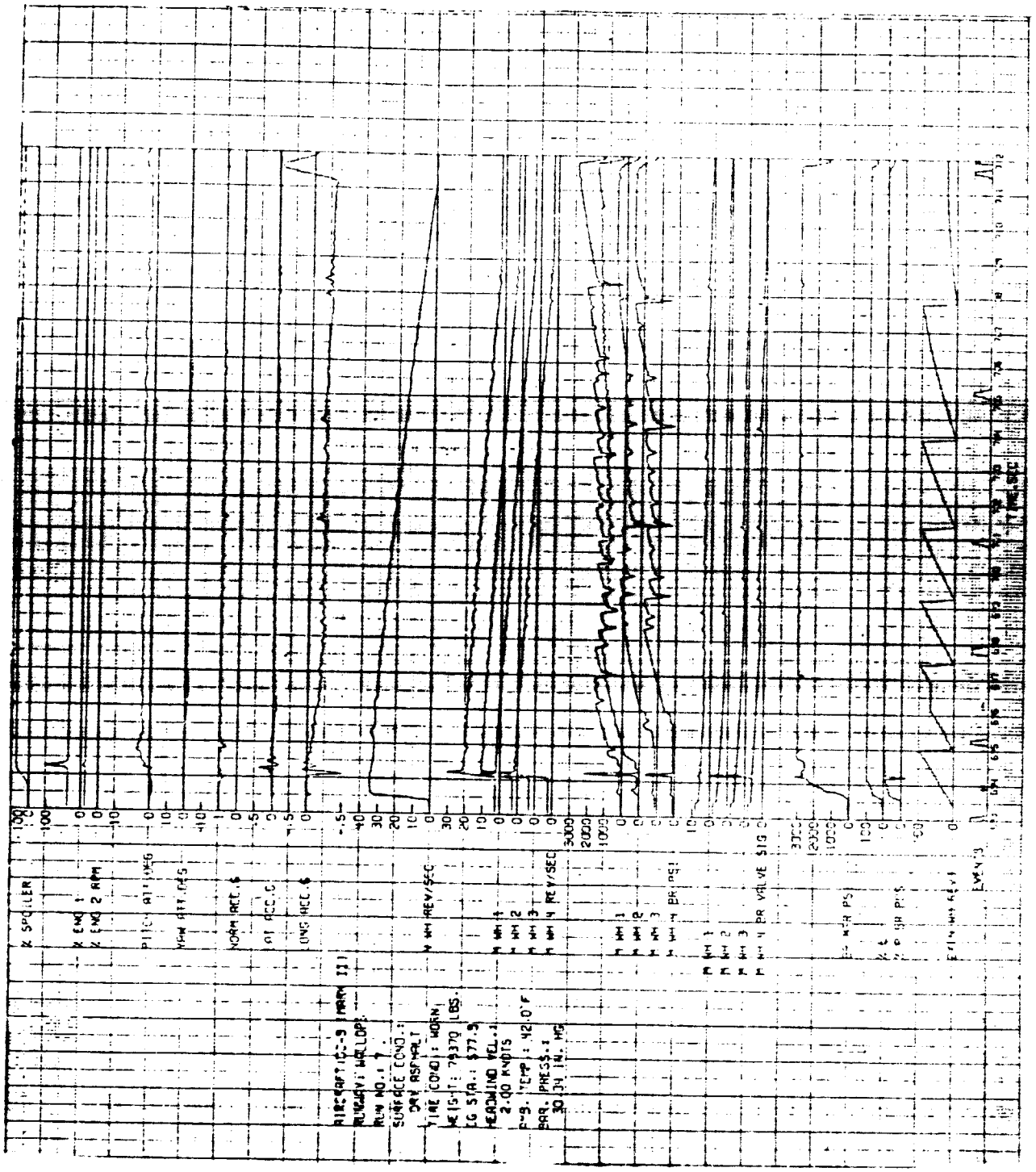
(No braking during run)

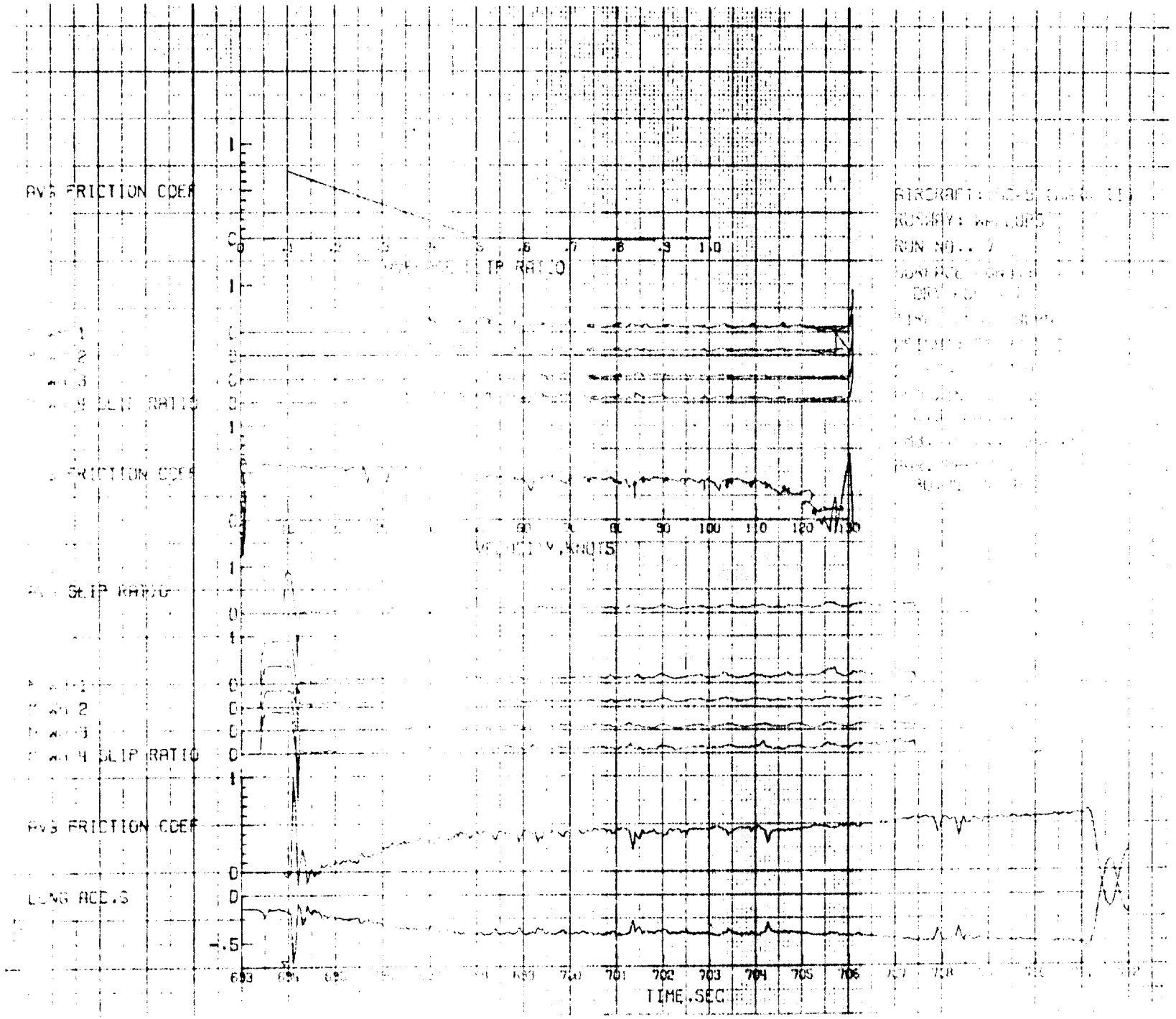

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-9 (MARK II)
RUNWAY: ARCTOPS
RUN NO.: 5
SURFACE CON
DRY ASPHALT
TIRE CONC.: WORN
WEIGHT: 82270 LBS.
CG STA.: 578.0
HEADWIND VEL.:
3.90 KNOTS
AMB. TEMP.: 42.0°F
BAR. PRESS.:
30.34 IN. HG
REV/SEC
BR PSI
EVENTS
TIME,SEC

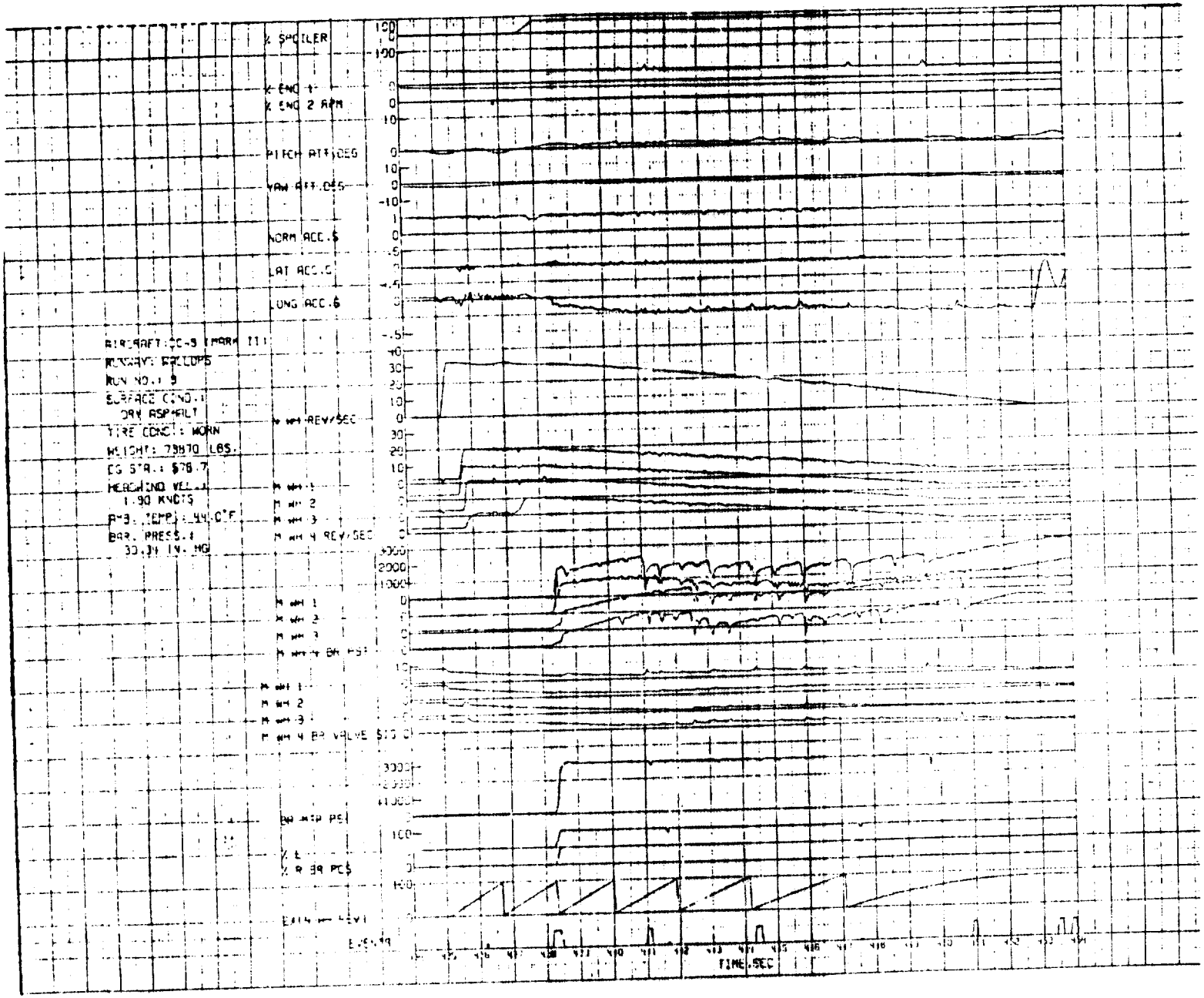

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: WALLOPS
RUN NO.: 6
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 82270 LBS.
CG STA.: 578.0
HEADWIND VEL.:
3.90 KNOTS
AMB. TEMP.: 42.0 F
BAR. PRESS.:
30.34 IN. HG

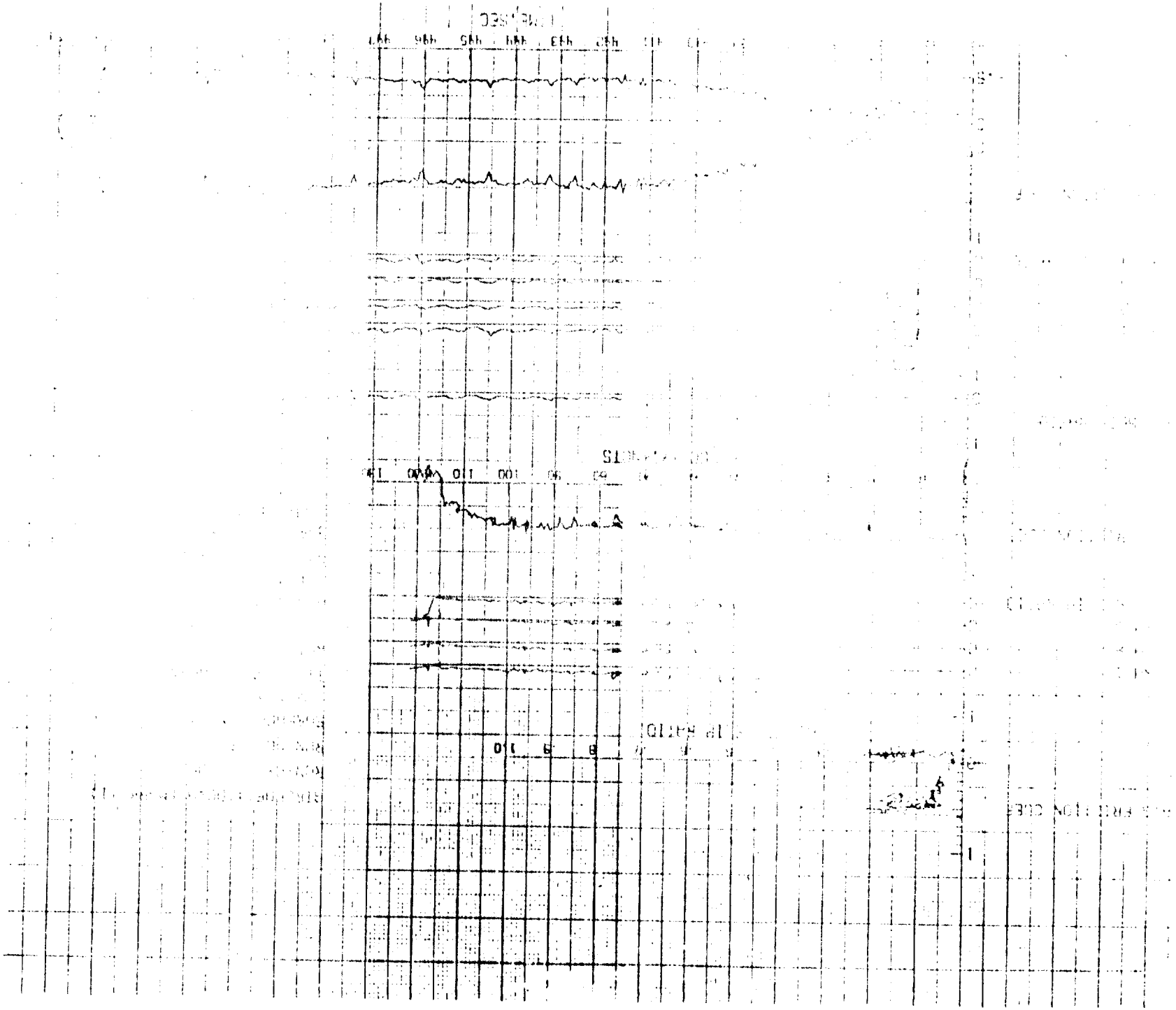

% SPOILER
% END 1
% END 2 PPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (MARK II)
RUNWAY: 07L/25R
RUN NO.: 69
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 80370 LBS.
CG STA.: 877.6
HEADING VEL.:
4.90 KNOTS
AMB. TEMP.: 42.0°F
BAR. PRESS.:
30.34 IN. HG
M WH REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 BR PSI
50%
M WH 1
M WH 2
M WH 3
M WH 4 BR VALVE SIG
BR MTR PSI
% BR POS
TIME SEC

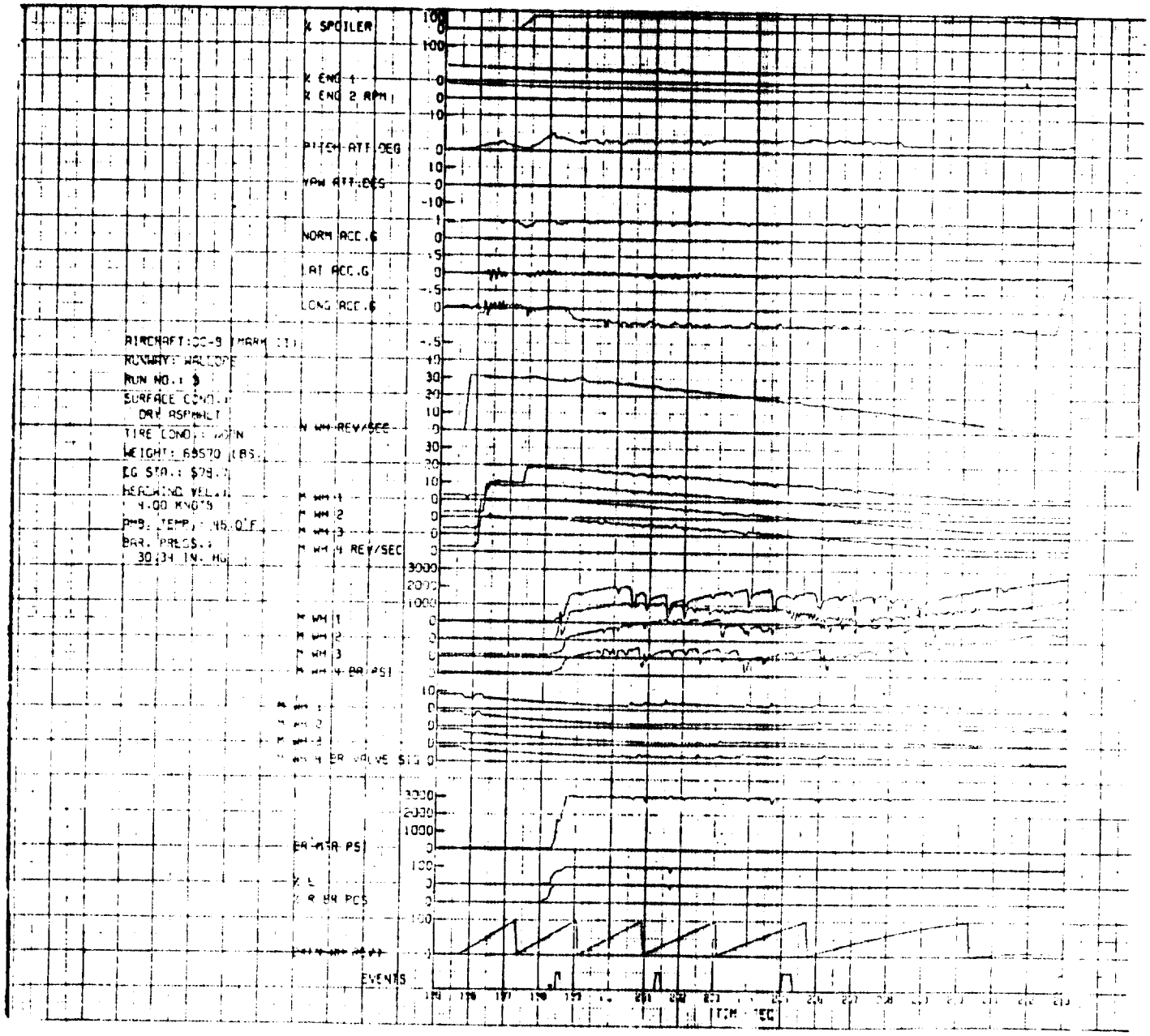

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: WALLOPS
RUN NO.: 6A
SURFACE COND.: DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 80370 LBS.
CG STA.: 577.6
HEADWIND VEL.: 4.90 KNOTS
AMB. TEMP.: 42.0 F
BAR. PRESS.: 30.34 IN. HG

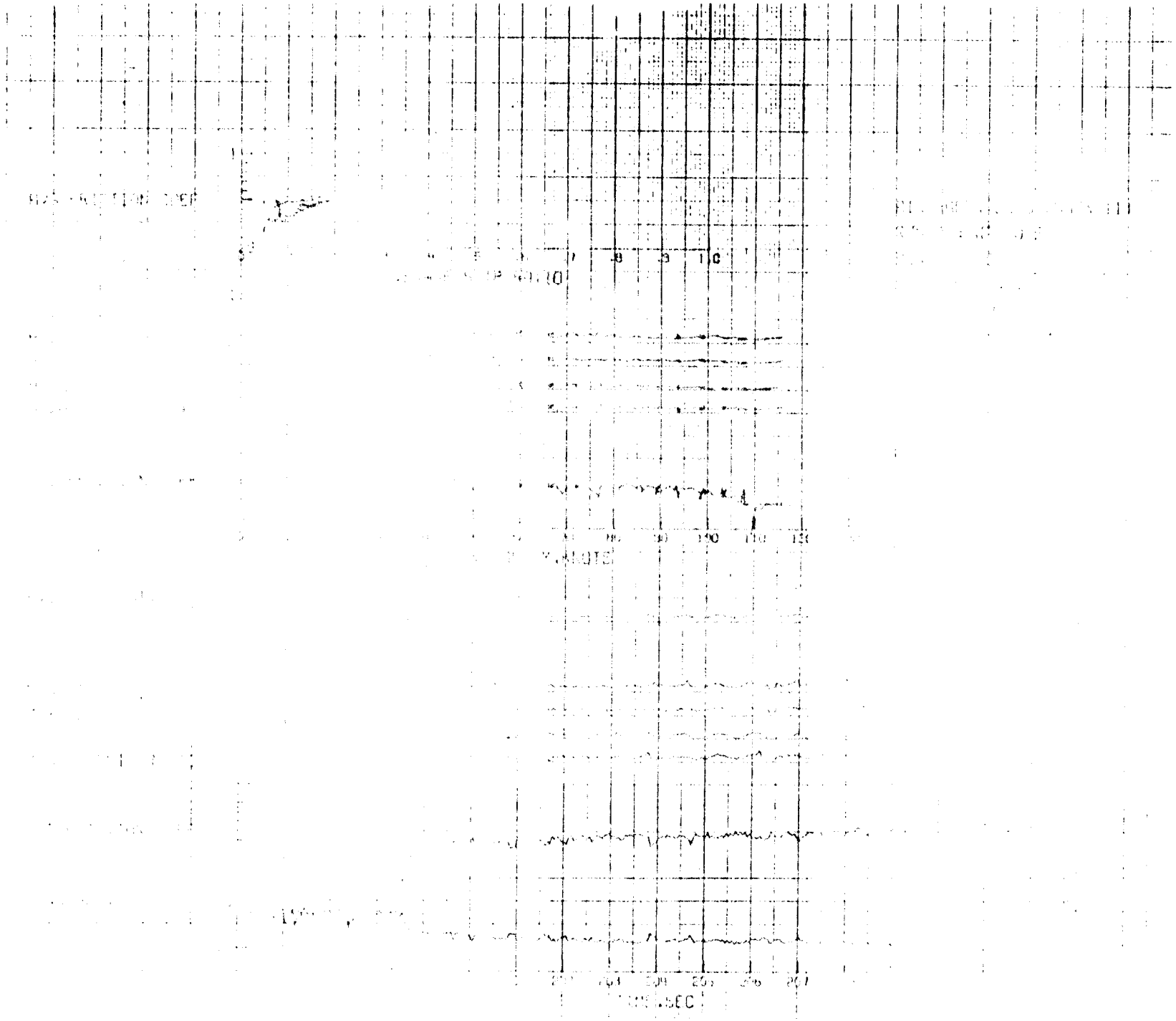

R SPOILER
R ENG 1 RPM
R ENG 2 RPM
PITCH ATTITUDE
NORM ACCEL
LONG ACCEL
RUNWAY: WALLOPS
RUN NO.: 7
SURFACE COND.: DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 79370 LBS.
CG STA.: 577.3
HEADWIND VEL.: 2.00 KNOTS
AMB. TEMP.: 42.0°F
BAR. PRESS.: 30.34 IN. HG
R WH 1 REV/SEC
R WH 2
R WH 3
R WH 4
R WH 1 BRK PSI
R WH 2
R WH 3
R WH 4
BRK VALVE SIG
PSI
PSI
EVENTS


AVG FRICTION COEF
SLIP RATIO
SLIP RATIO
FRICTION COEF
SLIP RATIO
SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC


% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT: CC-8 (MARK II)
RUNWAY: RALCORP5
RUN NO.: 9
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 73870 LBS.
CG STA.: 878.7
HEADWIND VEL.:
1.90 KNOTS
AMB. TEMP.: 44.0°F
BAR. PRESS.:
30.31 IN. HG
REV/SEC
BR PSI
BR VALVE
TIME,SEC

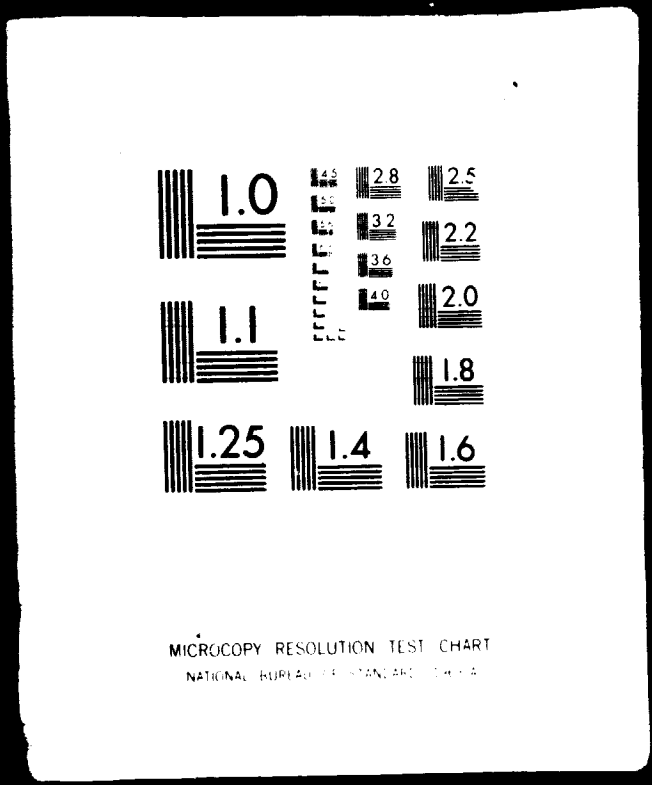


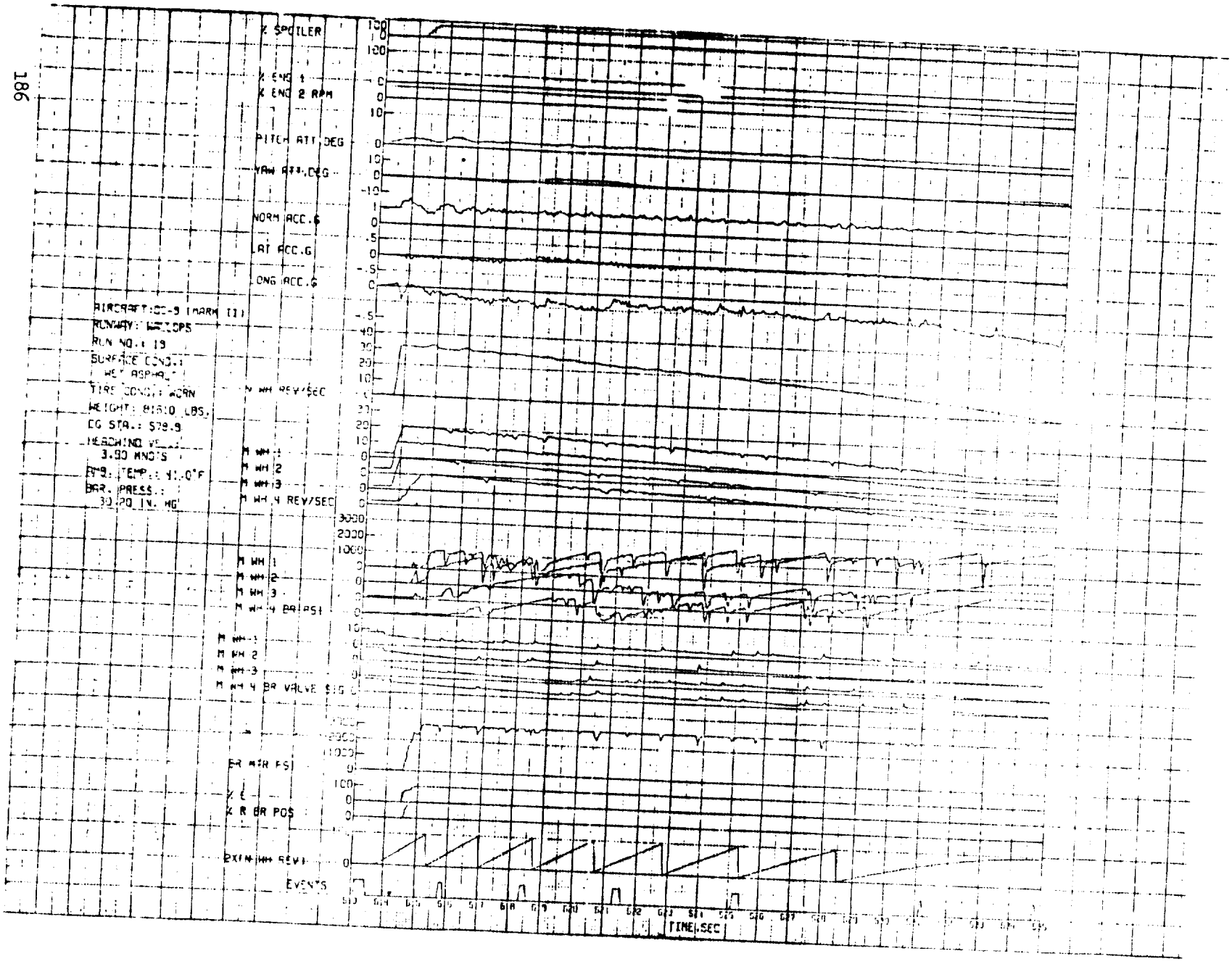

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9
RUNWAY: WALLOPS
RUN NO.: 9
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 69570 LBS.
CG STA.: 529.3
HEADING VEL.:
4.00 KNOTS
AMB. TEMP.: 46.0°F
BAR. PRESS.:
30.34 IN. HG
EVENTS
TIME SEC



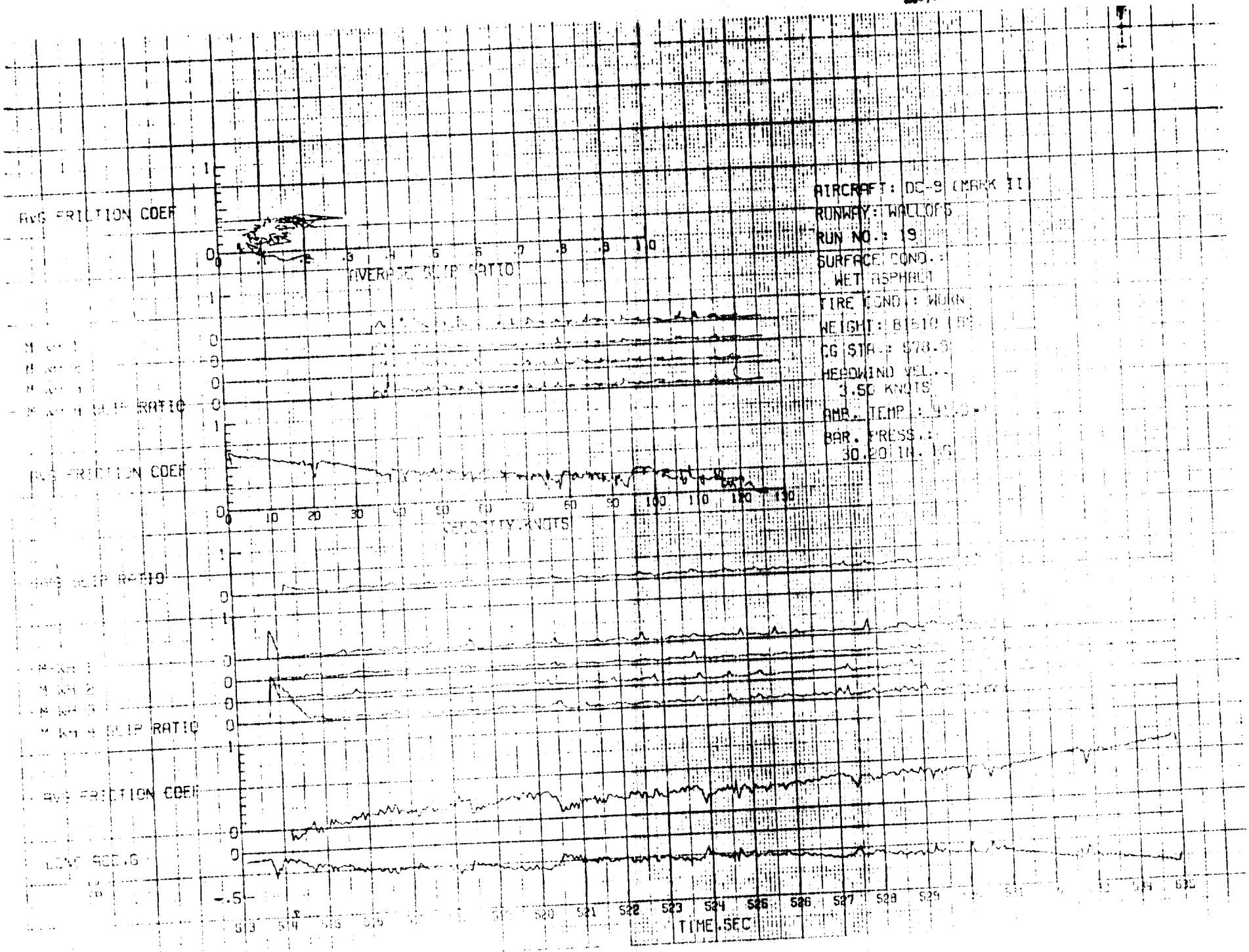
3 OF 4

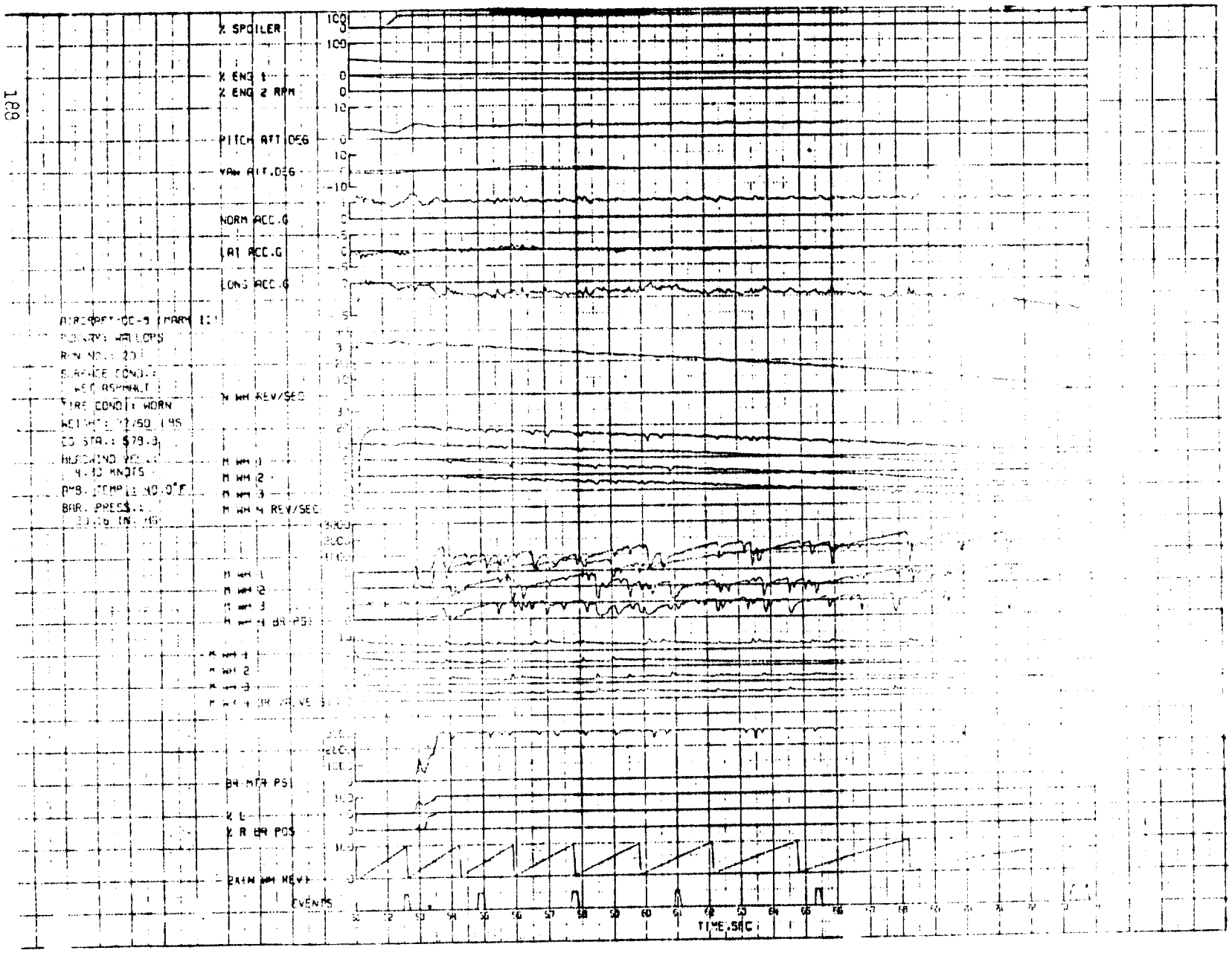
N77 27133 UNCLAS

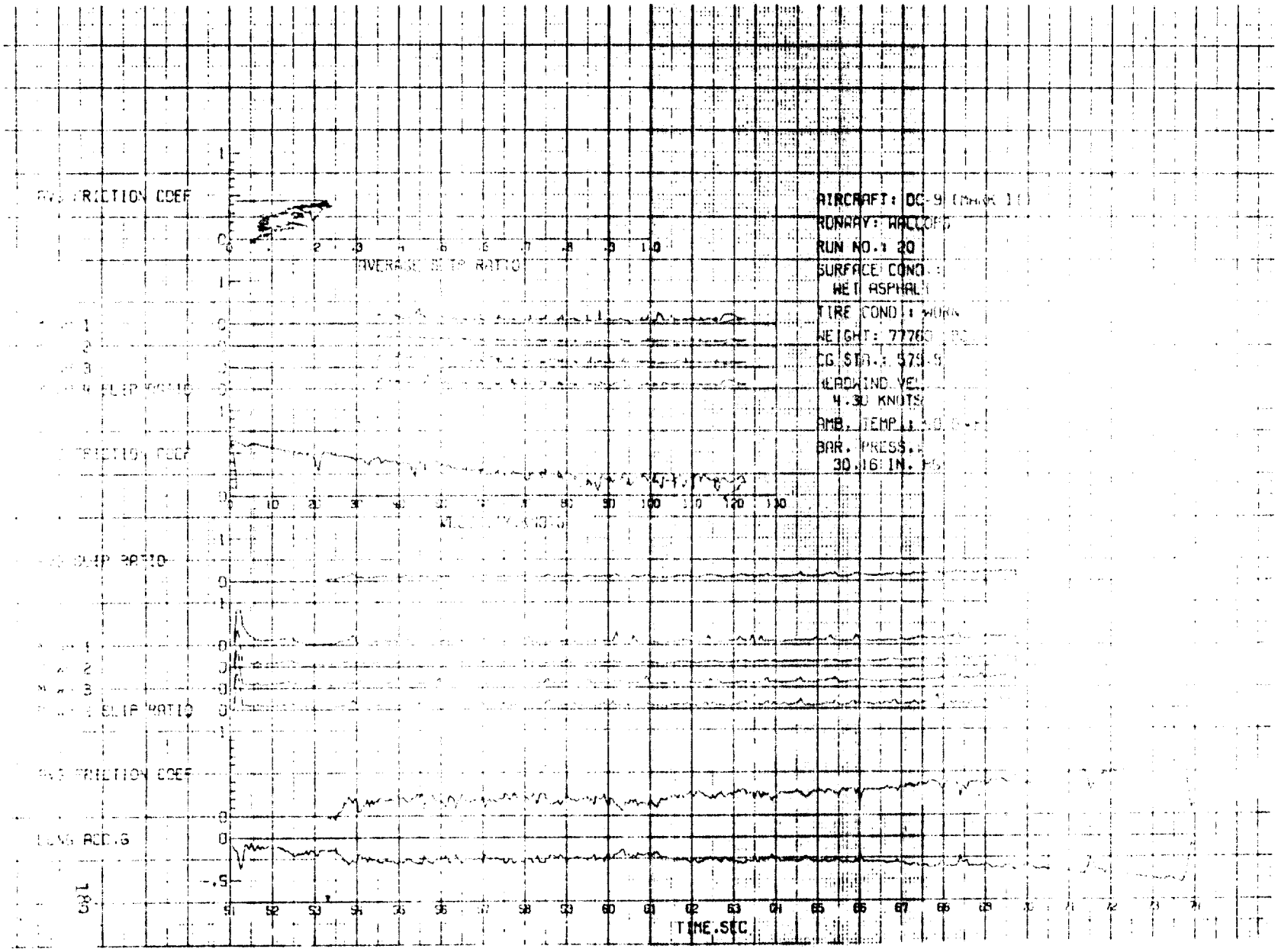


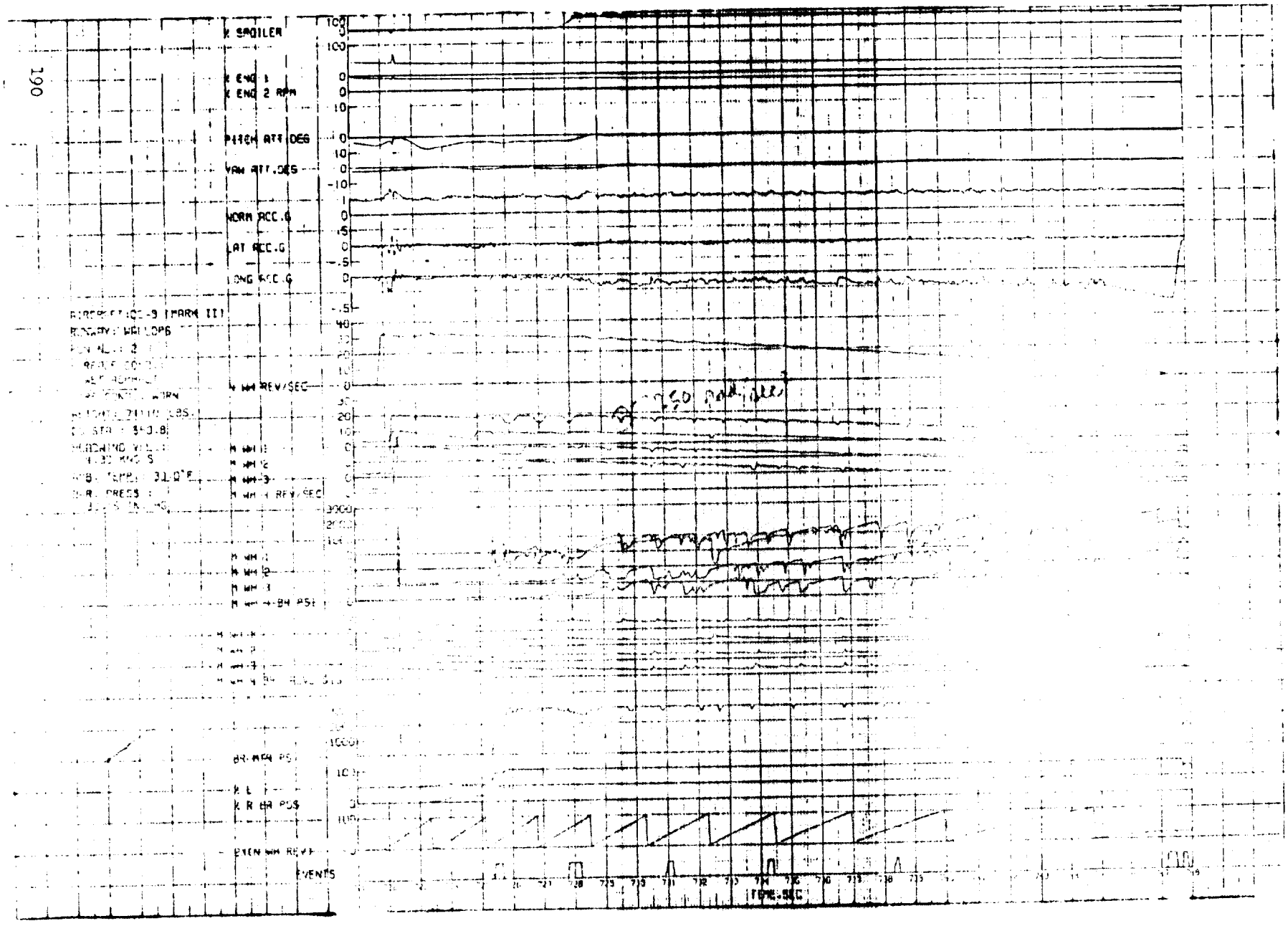

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT, DEG
YAW ATT, DEG
NORM ACC.G
LAT ACC.G
LNG ACC.G
AIRCRAFT: DC-9 (MARK II)
RUNWAY:
RUN NO.: 19
SURFACE COND.:
WET ASPHALT
TIRE COND.: WORN
WEIGHT: 81810 LBS.
CG STA.: 579.9
HEADWIND VEL.:
3.90 KNOTS
AMB. TEMP.: 41.0°F
BAR. PRESS.:
30.20 IN. HG
WH REV/SEC
WH 1
WH 2
WH 3
WH 4 REV/SEC
WH 1
WH 2
WH 3
WH 4 BRAKE PSI
WH 1
WH 2
WH 3
WH 4 BR VALVE SIG
BR MSTR PSI
% L BR POS
% R BR POS
EXIT WH REV
EVENTS
TIME, SEC

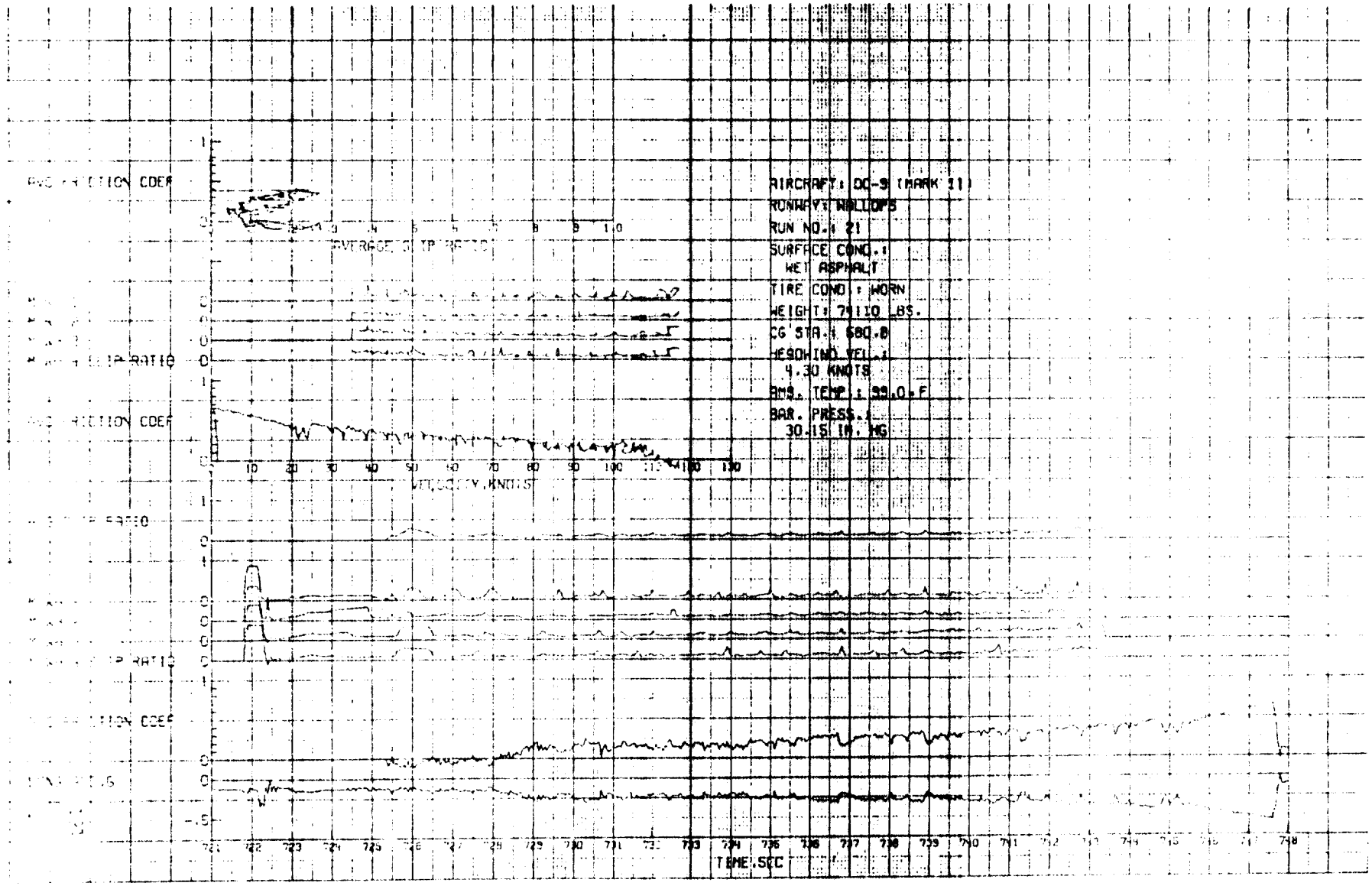
REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

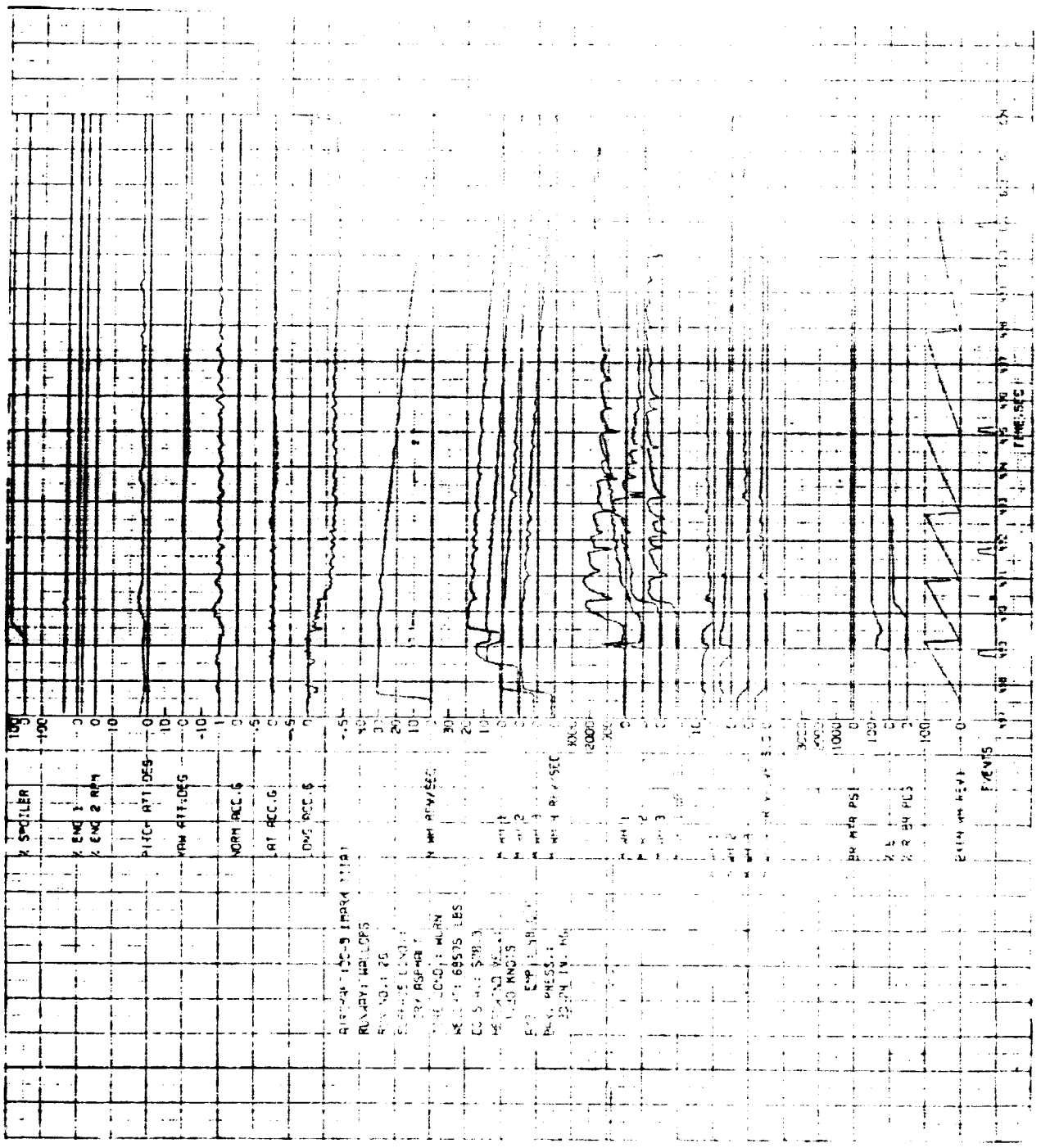


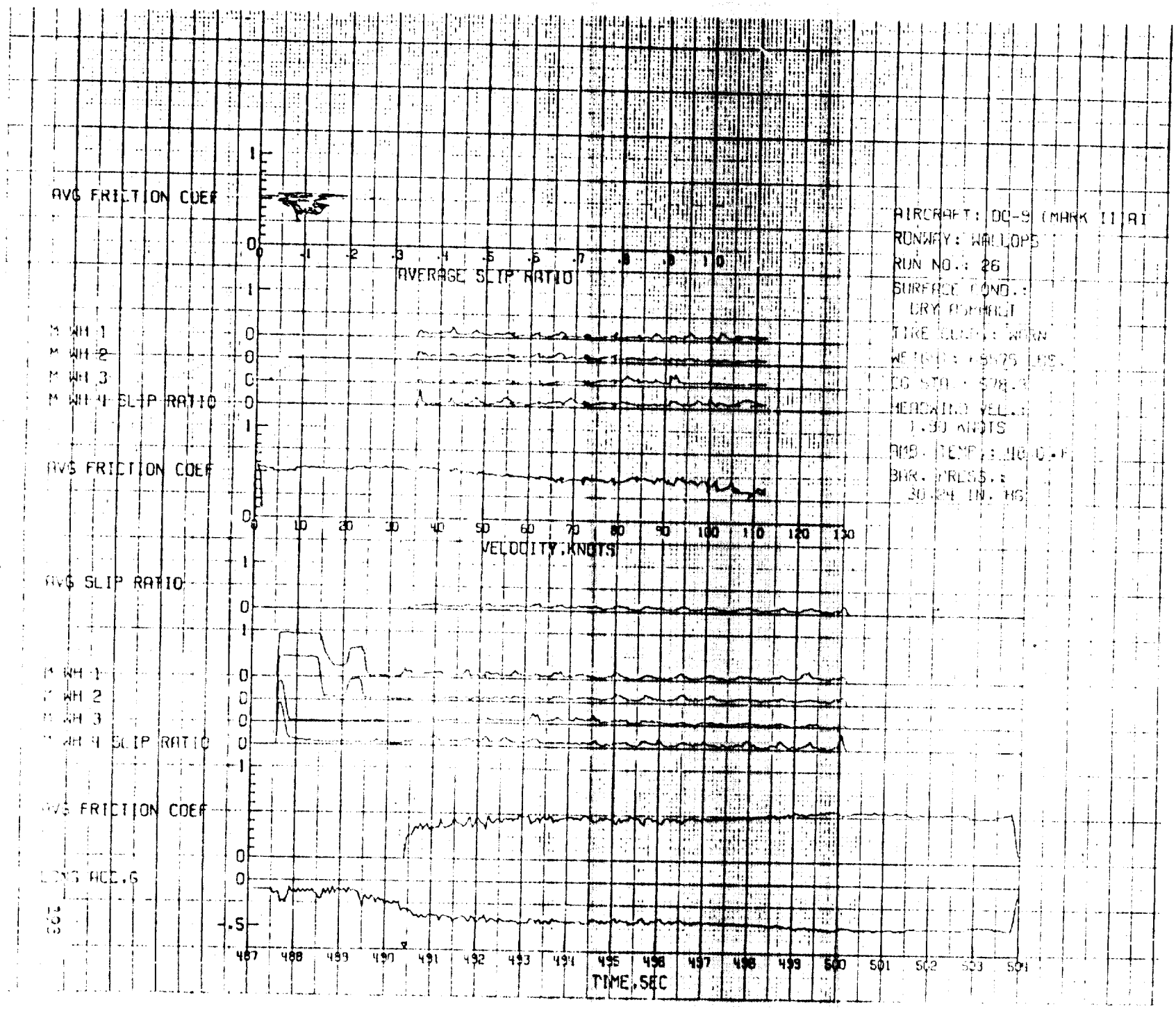

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
N WH REV/SEC
N WH 0
N WH 2
N WH 3
N WH 4 REV/SEC
BR MTR PSI
% L
% R BR POS
EVENTS
TIME,SEC

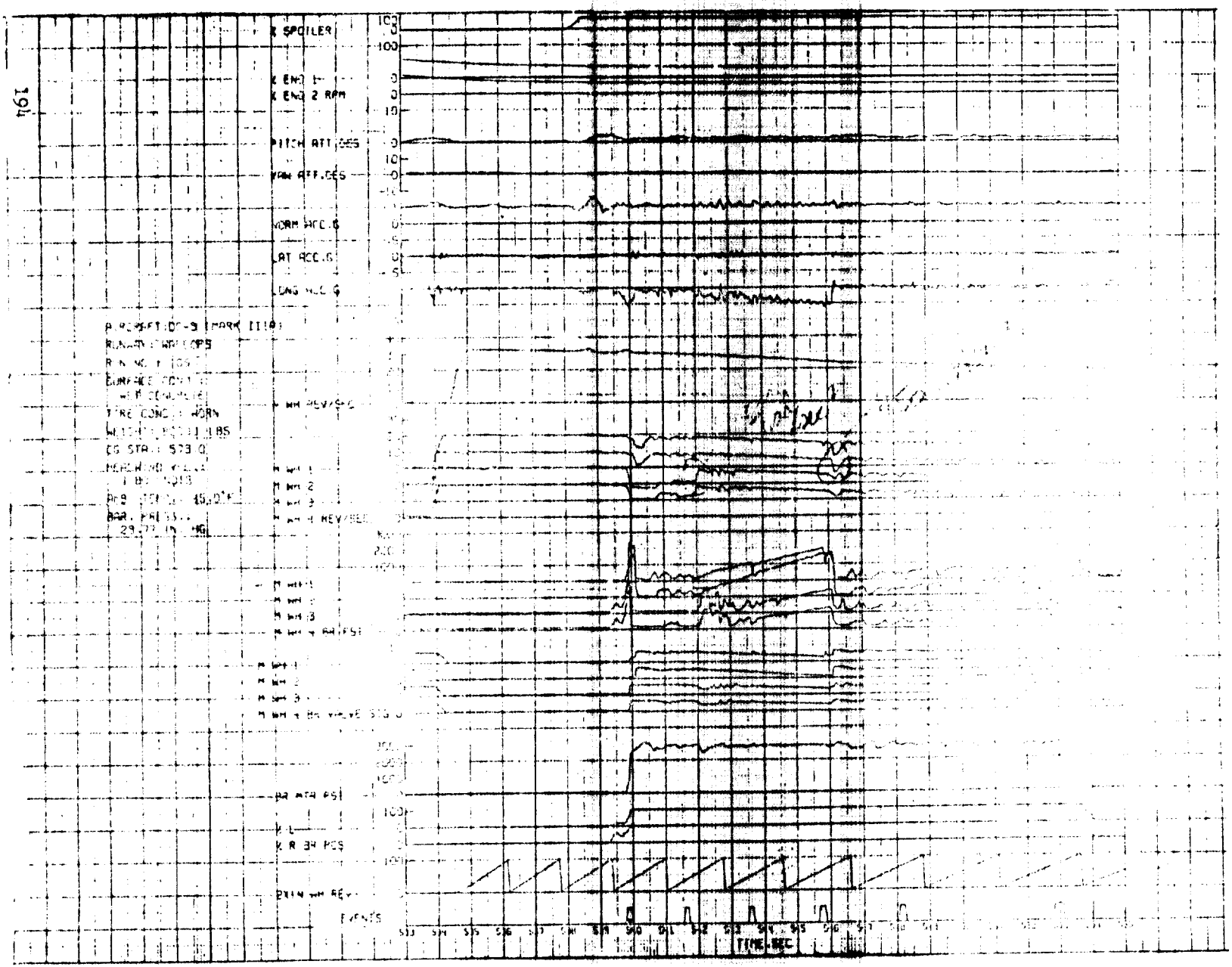

AIRCRAFT: DC-9
RUN NO.: 20
SURFACE COND.:
WET ASPHALT
TIRE COND.: WORN
WEIGHT: 77760
CG STA.: 575.9
HEADWIND VEL.
4.30 KNOTS
AMB. TEMP.:
BAR. PRESS.:
30.16 IN. HG
AVERAGE SLIP RATIO
TIME,SEC

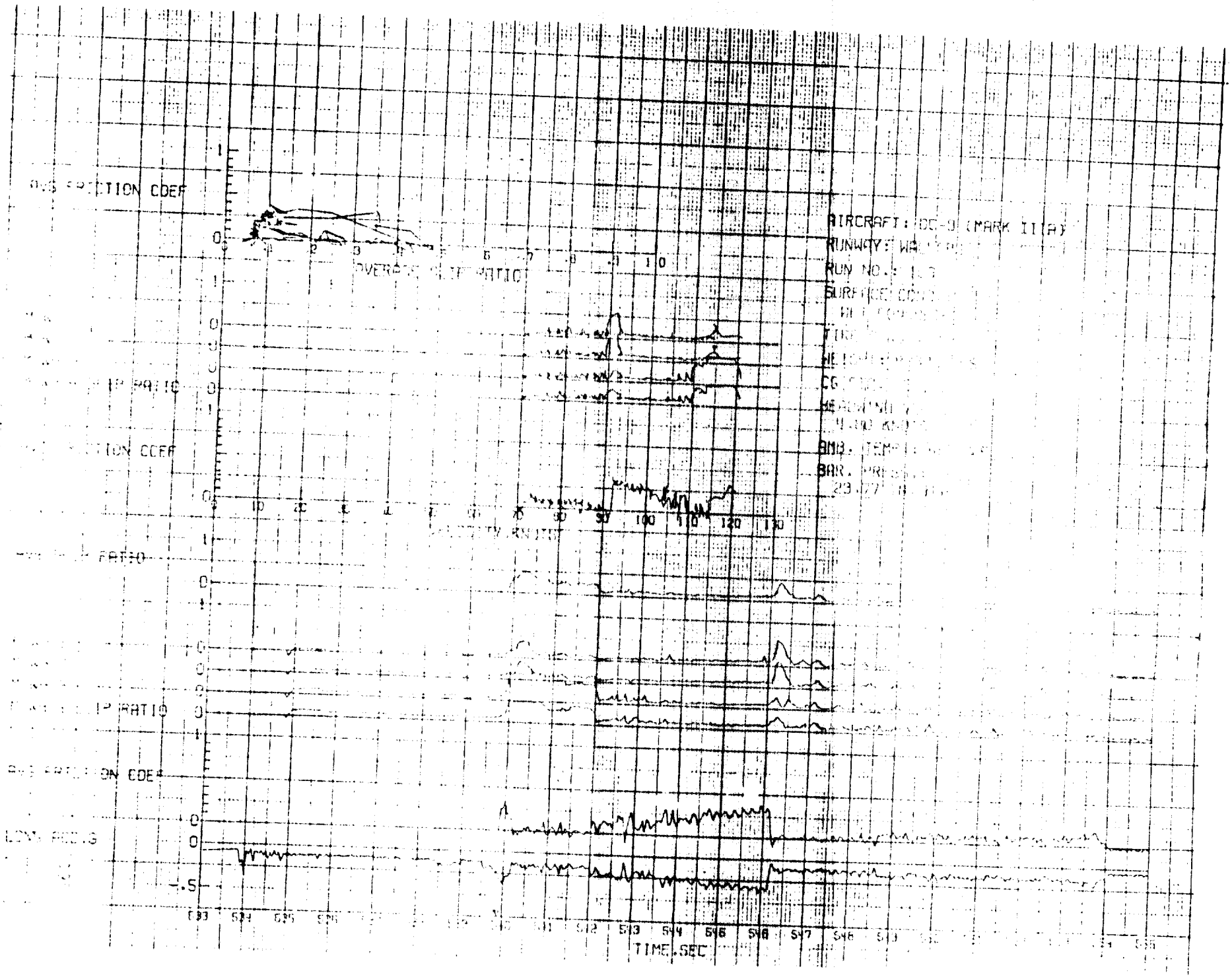

SPOILER
PITCH ATT DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
EVENTS
TIME-SEC

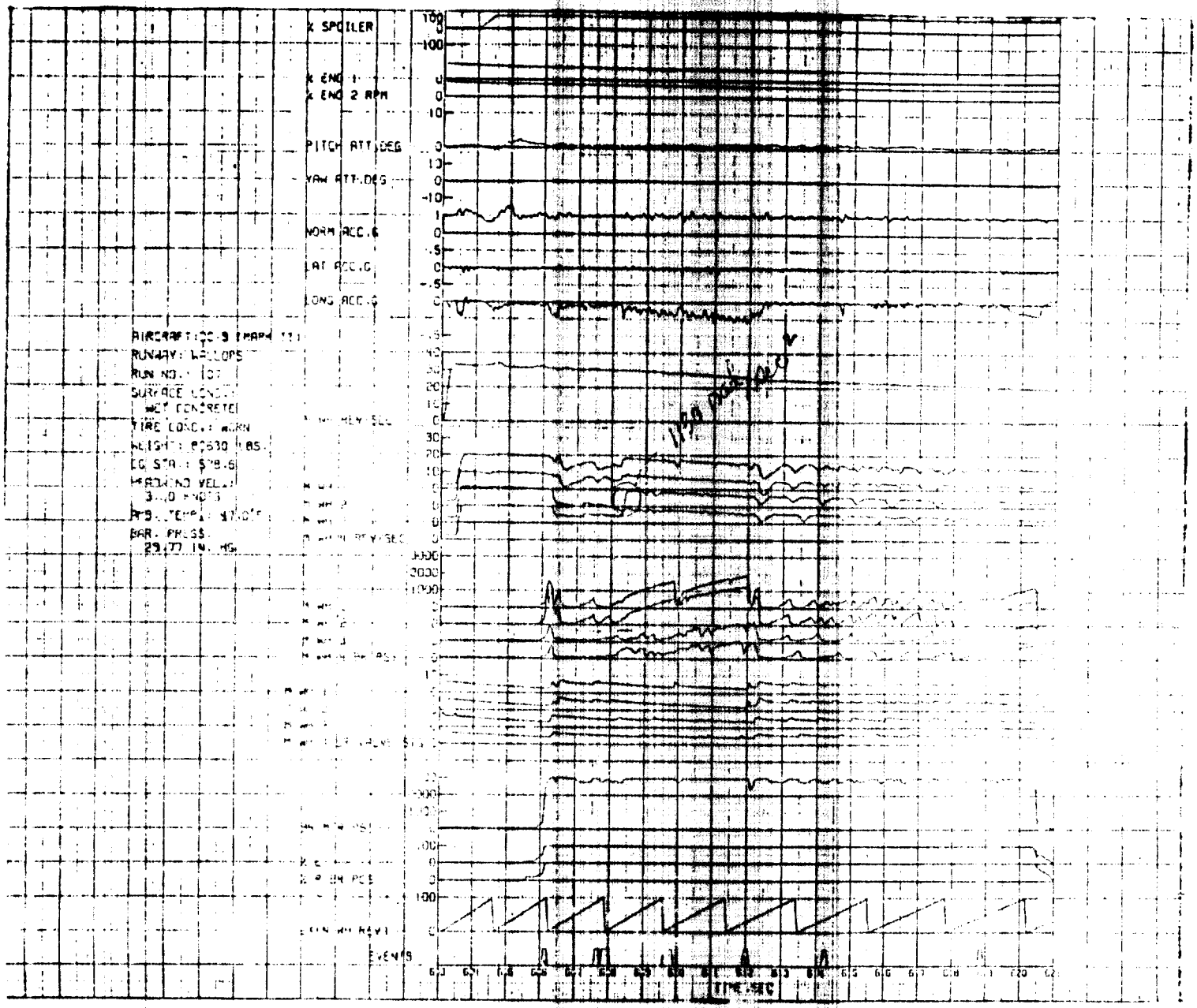

AIRCRAFT: DC-9 (MARK 1)
RUNWAY: WALLOPS
RUN NO.: 21
SURFACE COND.:
WET ASPHALT
TIRE COND.: WORN
WEIGHT: 79110 LBS.
CG STA.: 680.8
HEADWIND VEL.:
4.30 KNOTS
AMB. TEMP.: 99.0 F
BAR. PRESS.:
30.15 IN. HG
AVERAGE SLIP RATIO
VELOCITY, KNOTS
TIME, SEC

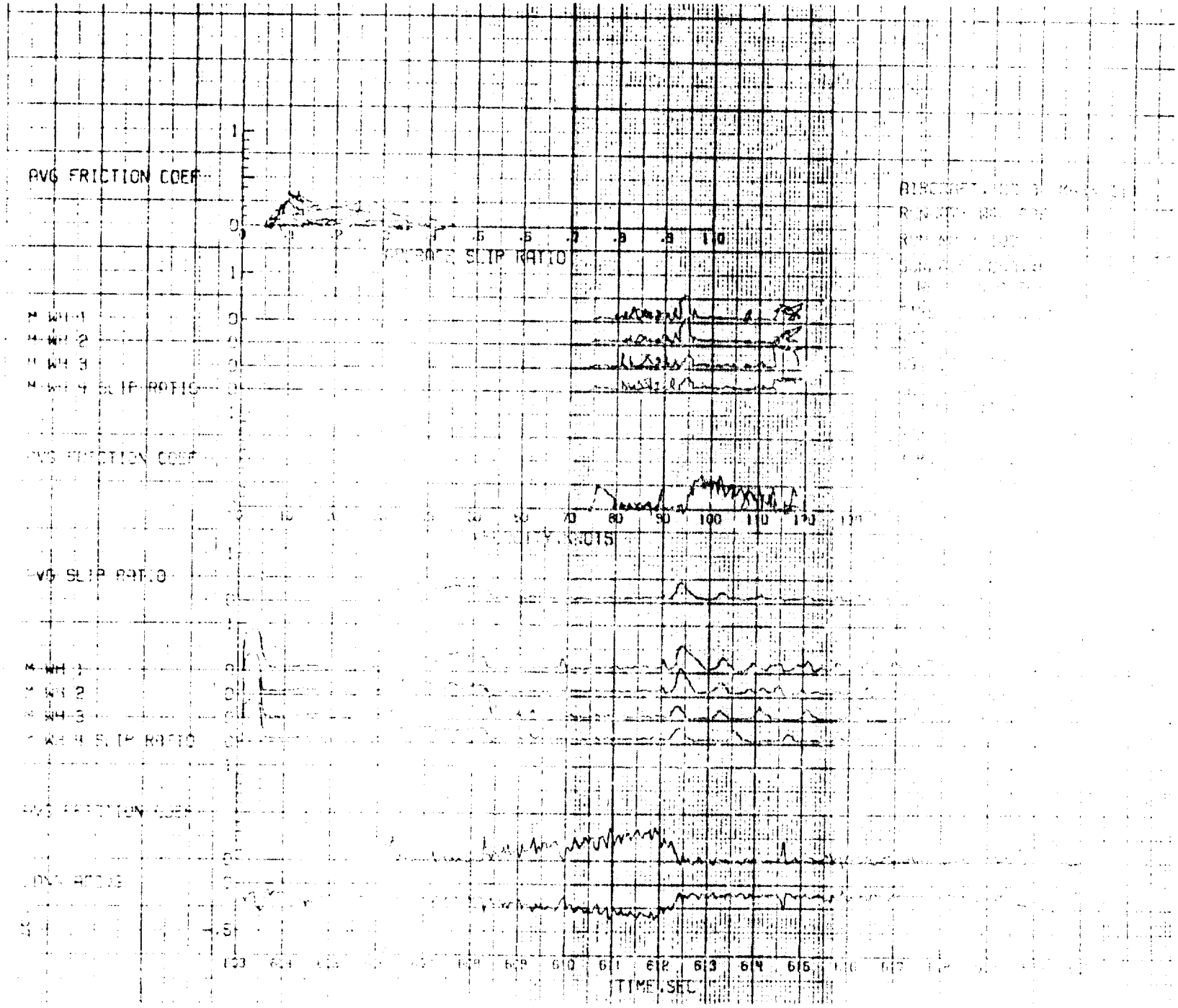

% SPOILER
% END 1
% END 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
AT ACC.G
SIDE ACC.G
FRAMES/SEC
EVENTS

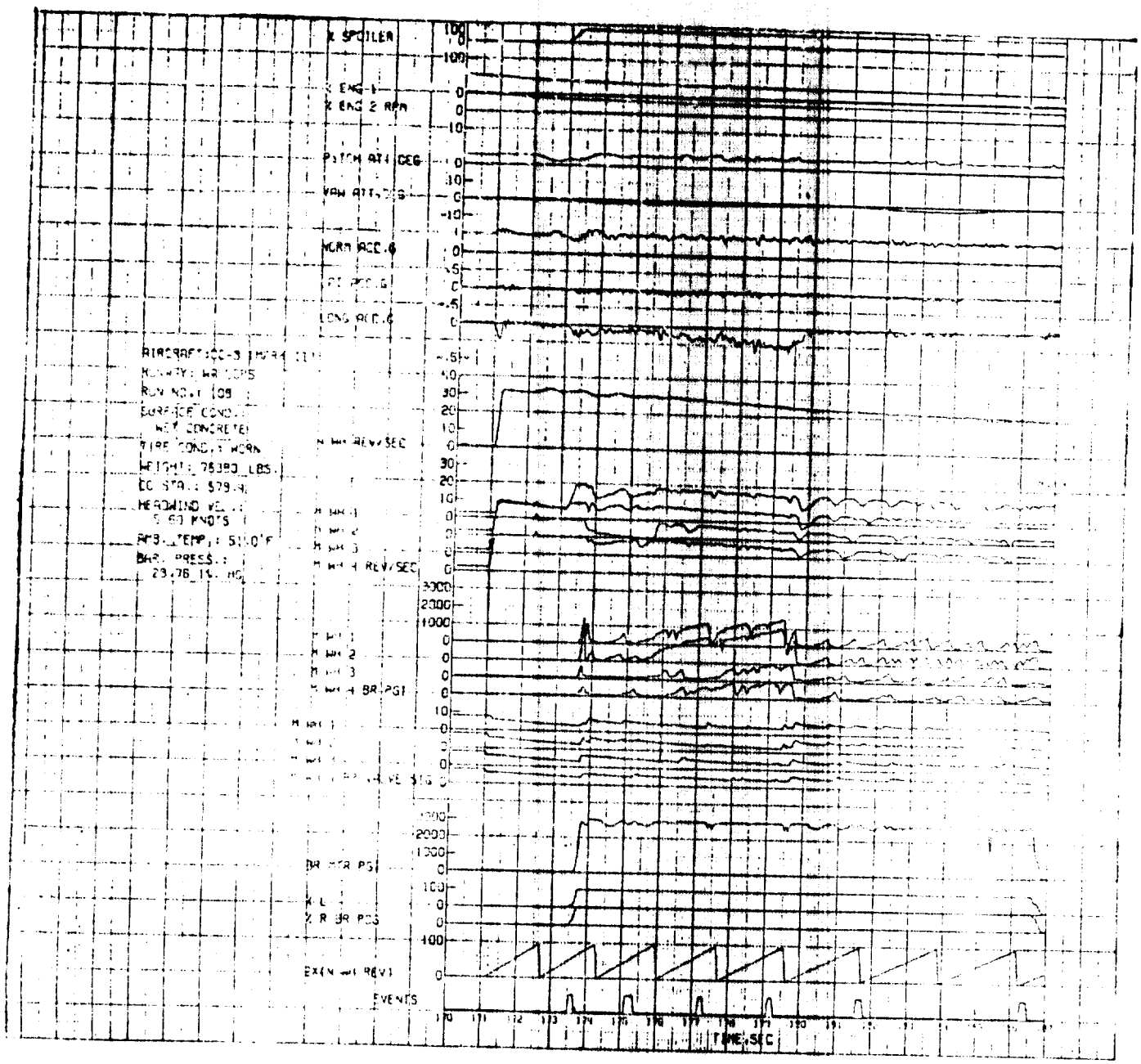

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK II) AI
RUNWAY: WALLOPS
RUN NO.: 26
SURFACE COND.:
DRY PCMARGT
TIRE
HEADWIND VEL.:
1.30 KNOTS
AMB. TEMP.:
BAR. PRESS.:
30.24 IN. HG

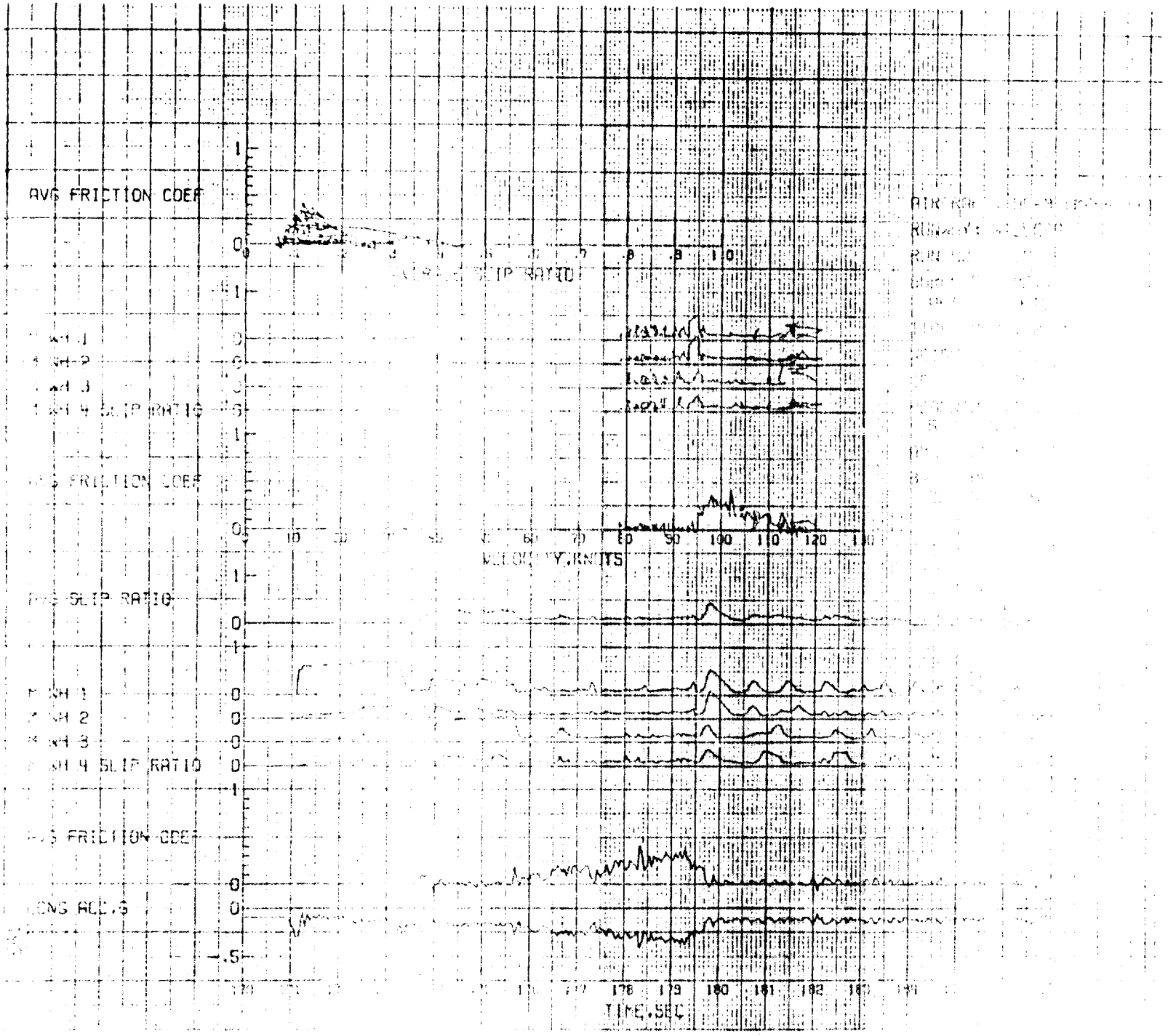

L SPOILER
L ENG 1
L ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
EVENTS
TIME-SEC

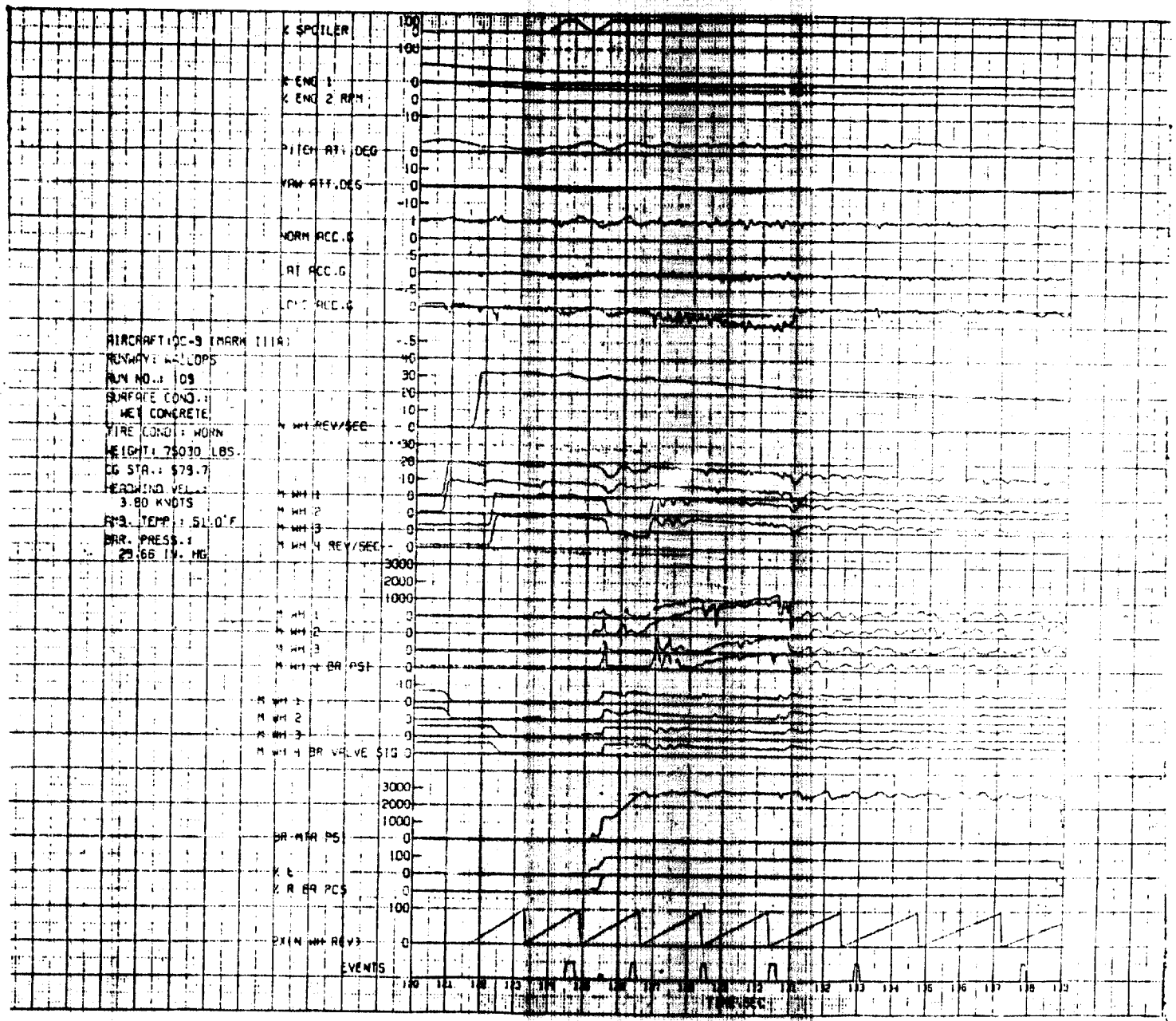

AIRCRAFT: DC-9 (MARK II A)
TIME, SEC

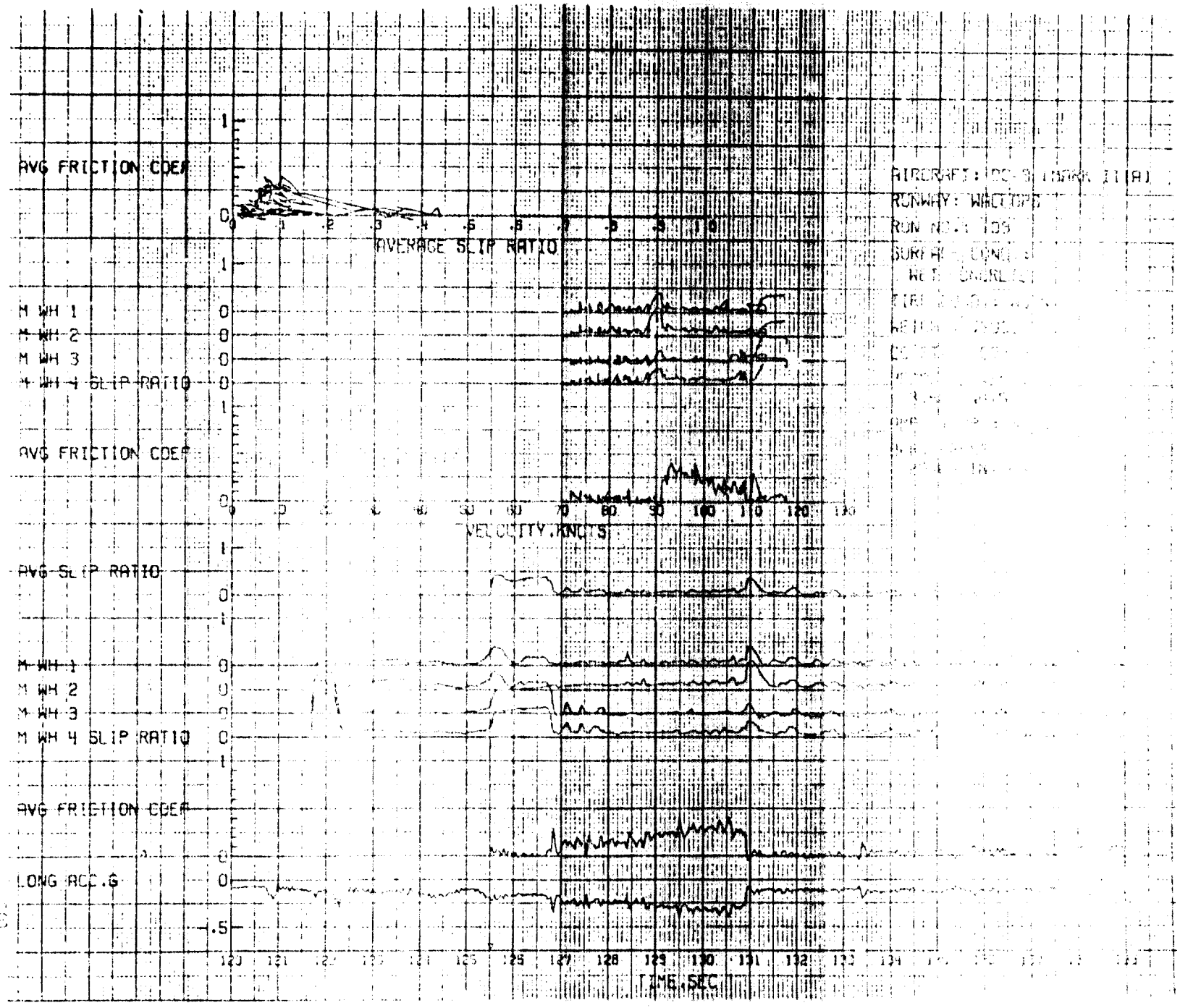

% SPOILER
% END 1
% END 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
RUNWAY: LRC LOPS
RUN NO.: 107
SURFACE COND.:
WET CONCRETE
TIRE COND.: WORN
WEIGHT: 82630 LBS.
CG STA.: 878.6
HEADWIND VEL.:
3.0 KNOTS
AMB. TEMP.: 81.0°F
BAR. PRESS.
29.77 IN. HG.
EVENTS
TIME SEC

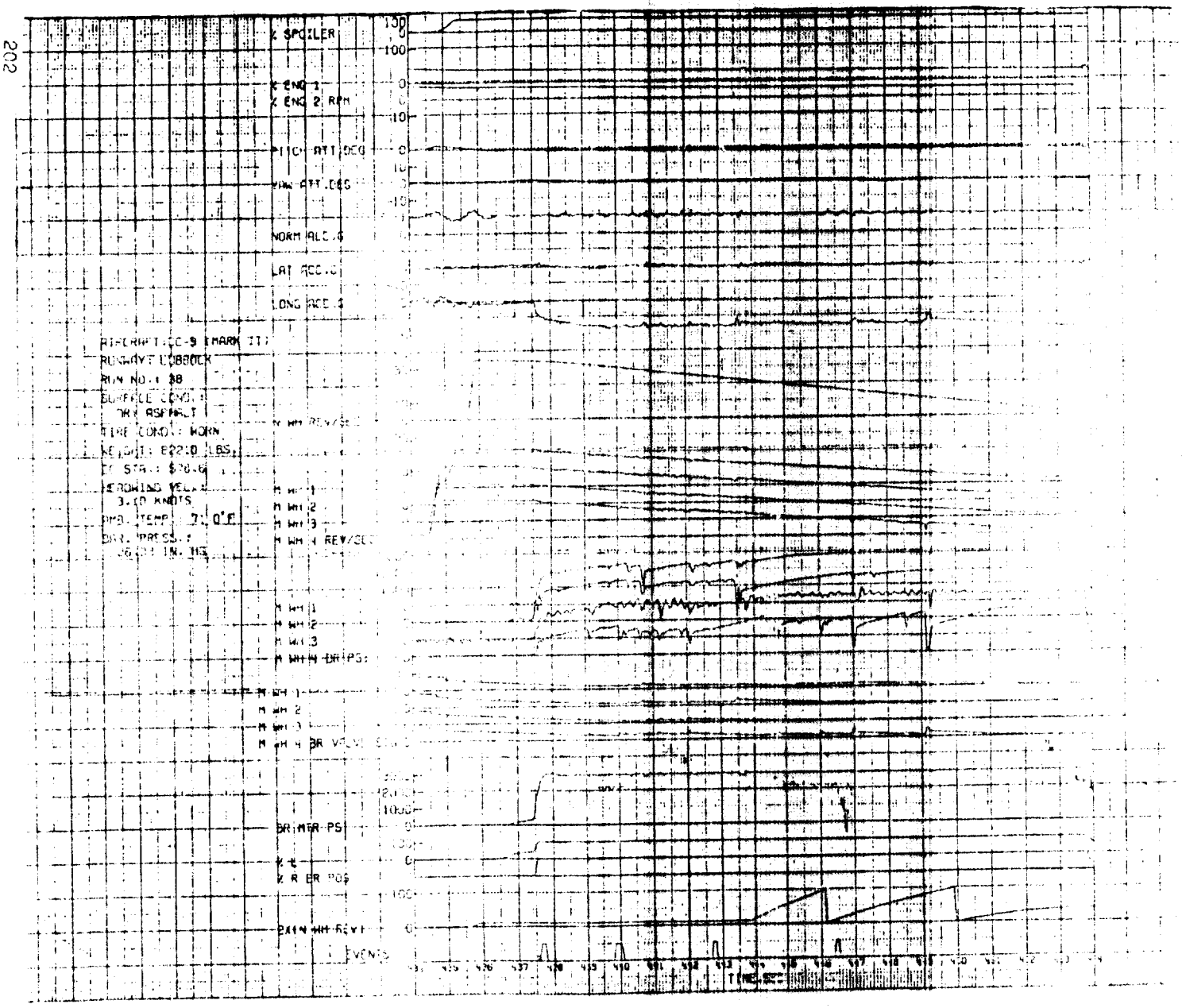

AVG FRICTION COEF
SLIP RATIO
WH 1
WH 2
WH 3
WH 4 SLIP RATIO
AVG FRICTION COEF
VS
AVG SLIP RATIO
WH 1
WH 2
WH 3
WH 4 SLIP RATIO
AVG FRICTION COEF
TIME, SEC

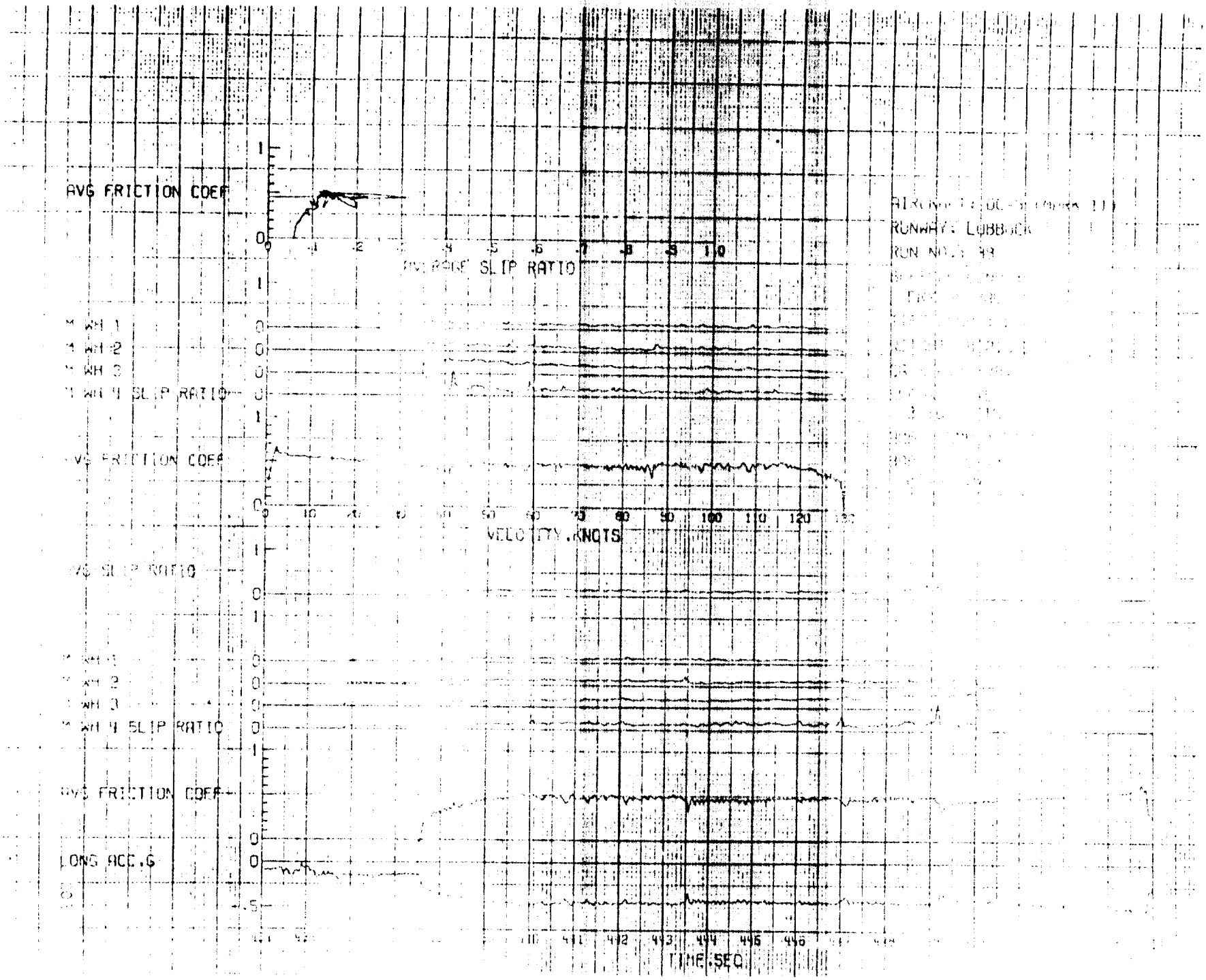

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT, DEG
YAW ATT, DEG
NORM ACC, G
LONG ACC, G
AIRCRAFT: CC-8
VELOCITY: 88 KEAS
RUN NO.: 109
SURFACE COND.:
DRY CONCRETE
TIRE COND.: NORM
WEIGHT: 76380 LBS.
CG STA.: 579.4
HEADWIND VEL.:
5.60 KNOTS
AMB. TEMP.: 51.0°F
BAR. PRESS.:
29.76 IN. HG
REV/SEC
BR PSI
BR PSI
EVENTS
TIME, SEC

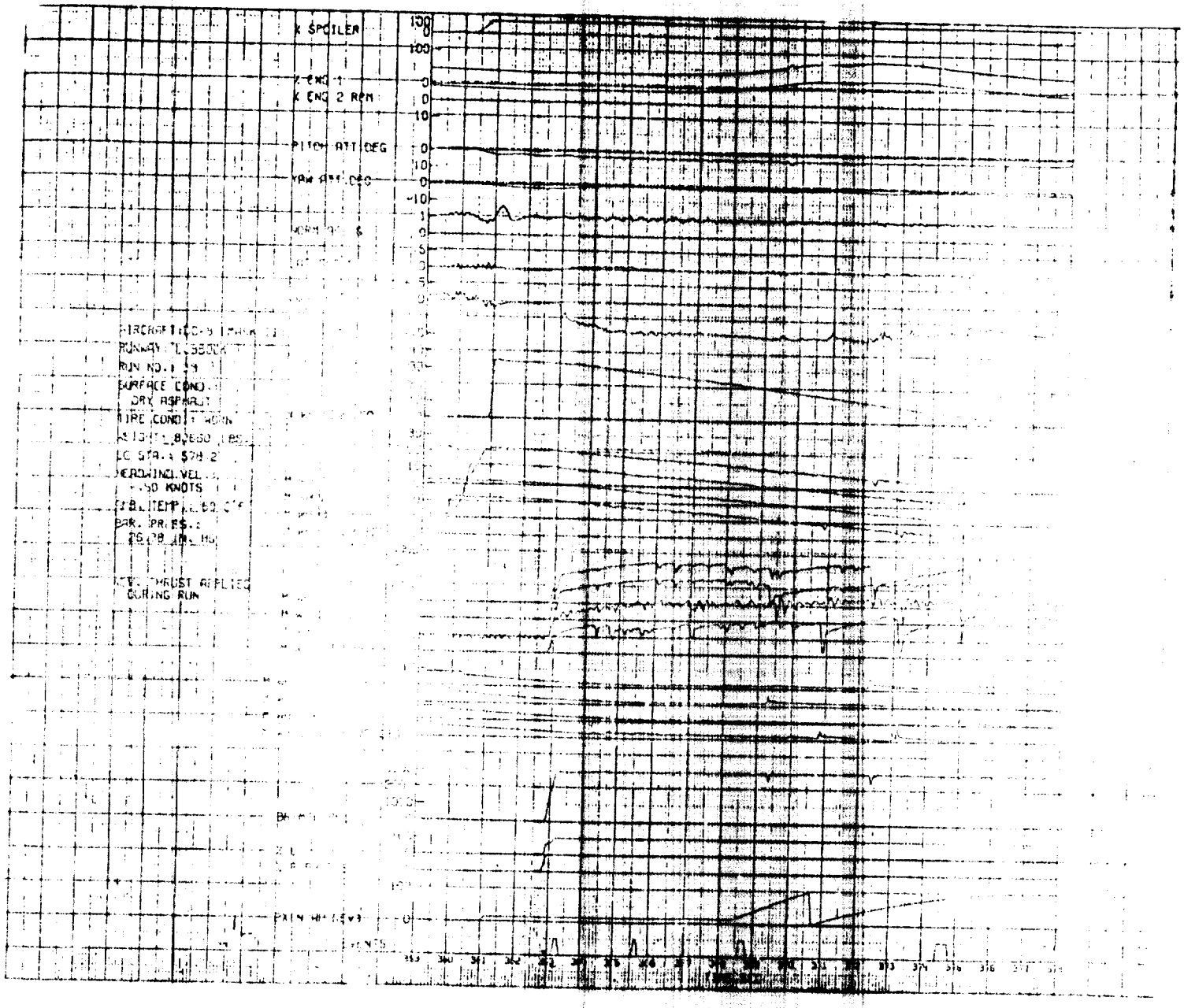

AVG FRICTION COEF
1
0
-1
WH 1
WH 2
WH 3
WH 4 SLIP RATIO
FRICTION COEF
SLIP RATIO
WH 1
WH 2
WH 3
WH 4 SLIP RATIO
FRICTION COEF
LONG ACC.g
-.5
TIME,SEC

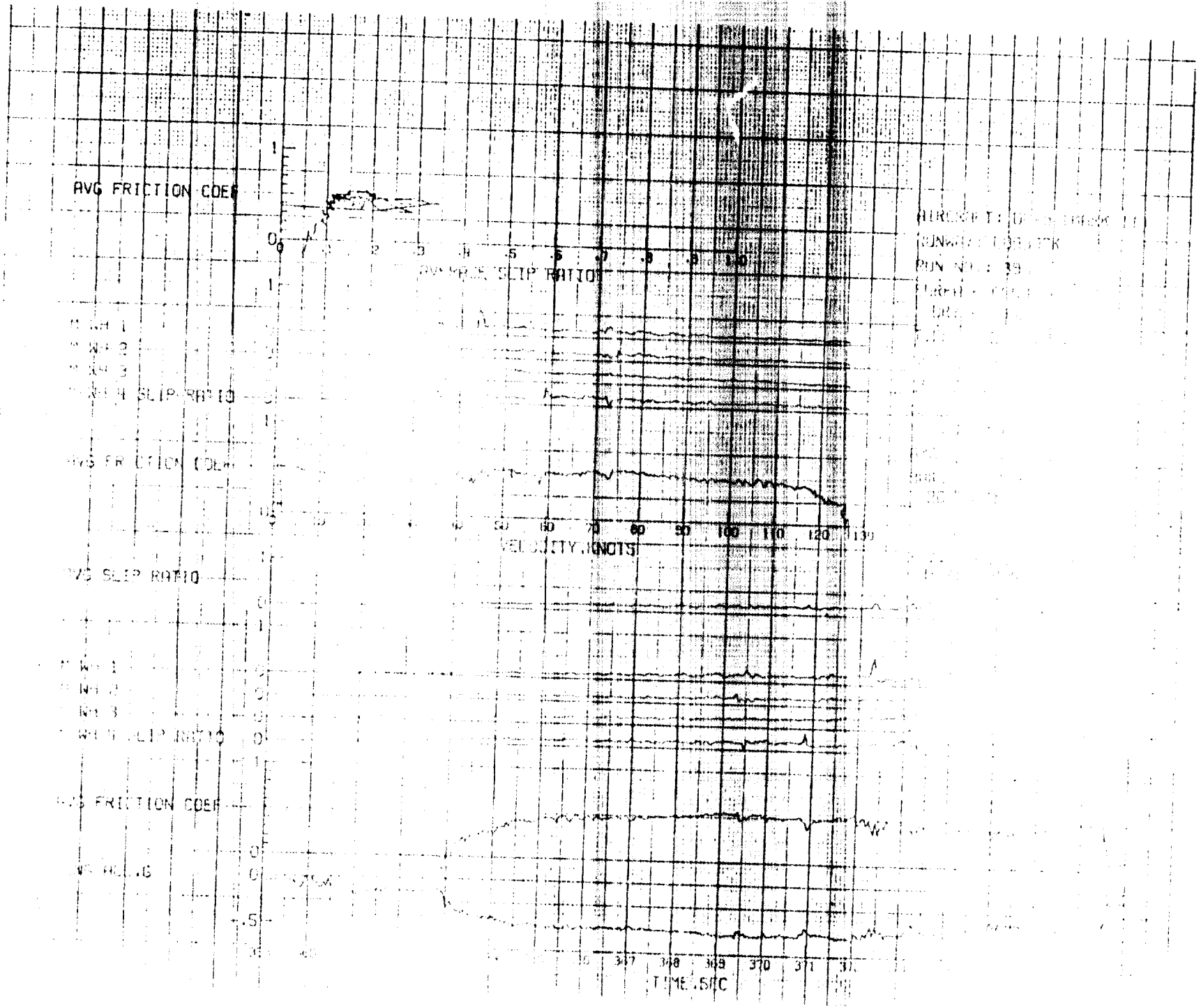

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
AT ACC.G
LAT ACC.G
AIRCRAFT:DC-9 (MARK III A)
RUNWAY: WALLOPS
RUN NO.: 09
SURFACE COND.:
WET CONCRETE
TIRE COND.: WORN
WEIGHT: 75030 LBS.
CG STA.: 879.7
HEADWIND VEL.:
3.80 KNOTS
AMB. TEMP.: 51.0°F
BAR. PRESS.:
29.66 IN. HG
M WH 1 REV/SEC
M WH 2
M WH 3
M WH 4 REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 BR PSI
M WH 1
M WH 2
M WH 3
M WH 4 BR VALVE SIG
BR-MTR PS
% L
% R BR PCS
PXIN WH REV
EVENTS
TIME SEC

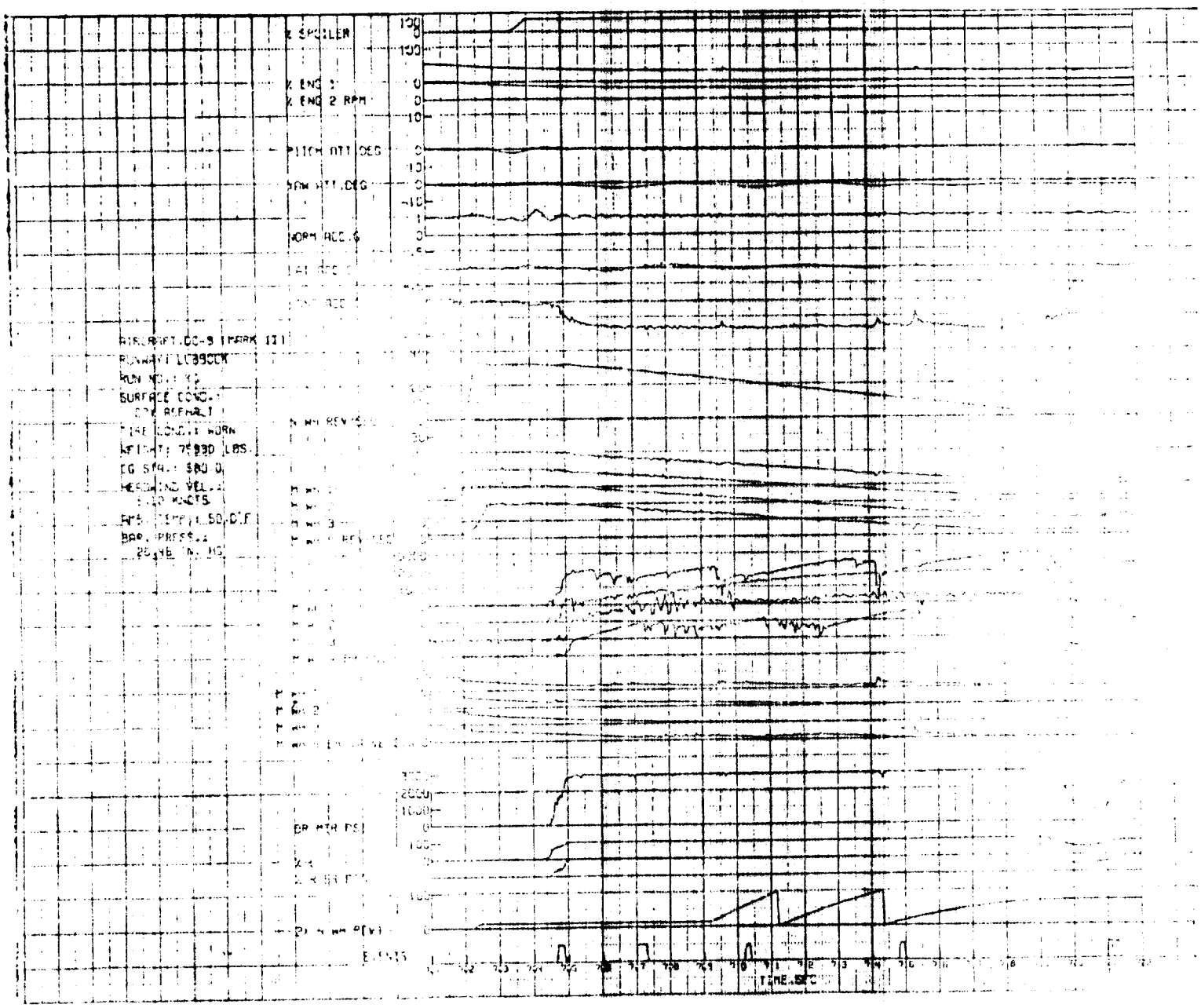

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC

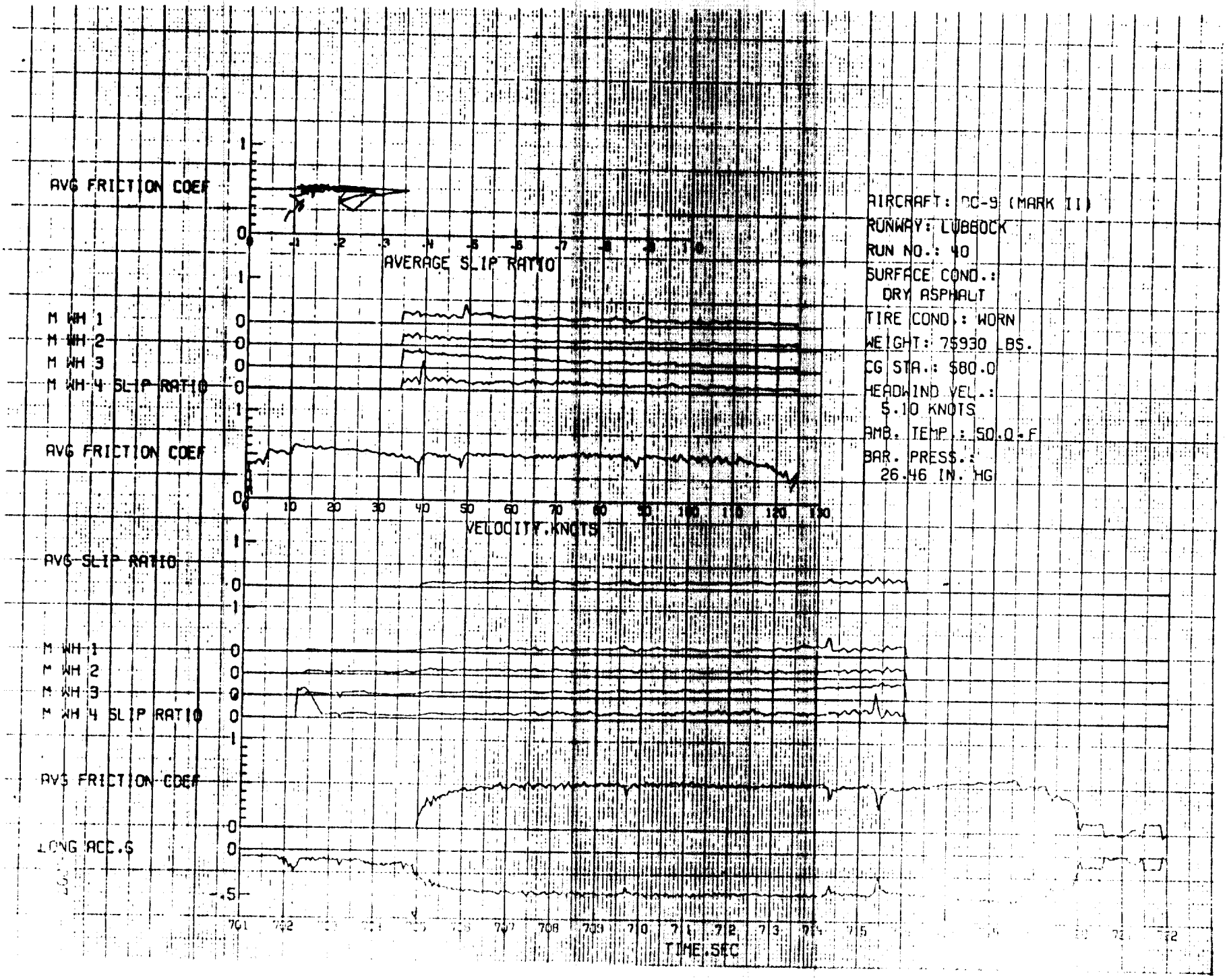

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT DEG
NORMAL ACC G
LAT ACC G
LONG ACC G
AIRCRAFT: CC-9 (MARK II)
RUNWAY: LUBBOCK
RUN NO.: 38
SURFACE COND:
DRY ASPHALT
TIRE COND: WORN
WEIGHT: 82210 LBS
CG STA.: 520.6
RECORDED VEL:
3.10 KNOTS
AMB. TEMP. 71.0°F
BAR. PRESS.:
28.92 IN. HG
M WH REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 BR PSI
M WH 1
M WH 2
M WH 3
M WH 4 BR VALVE
BRAKE PSI
% E
% R BR POS
MAIN WH REV
EVENTS
TIME SEC

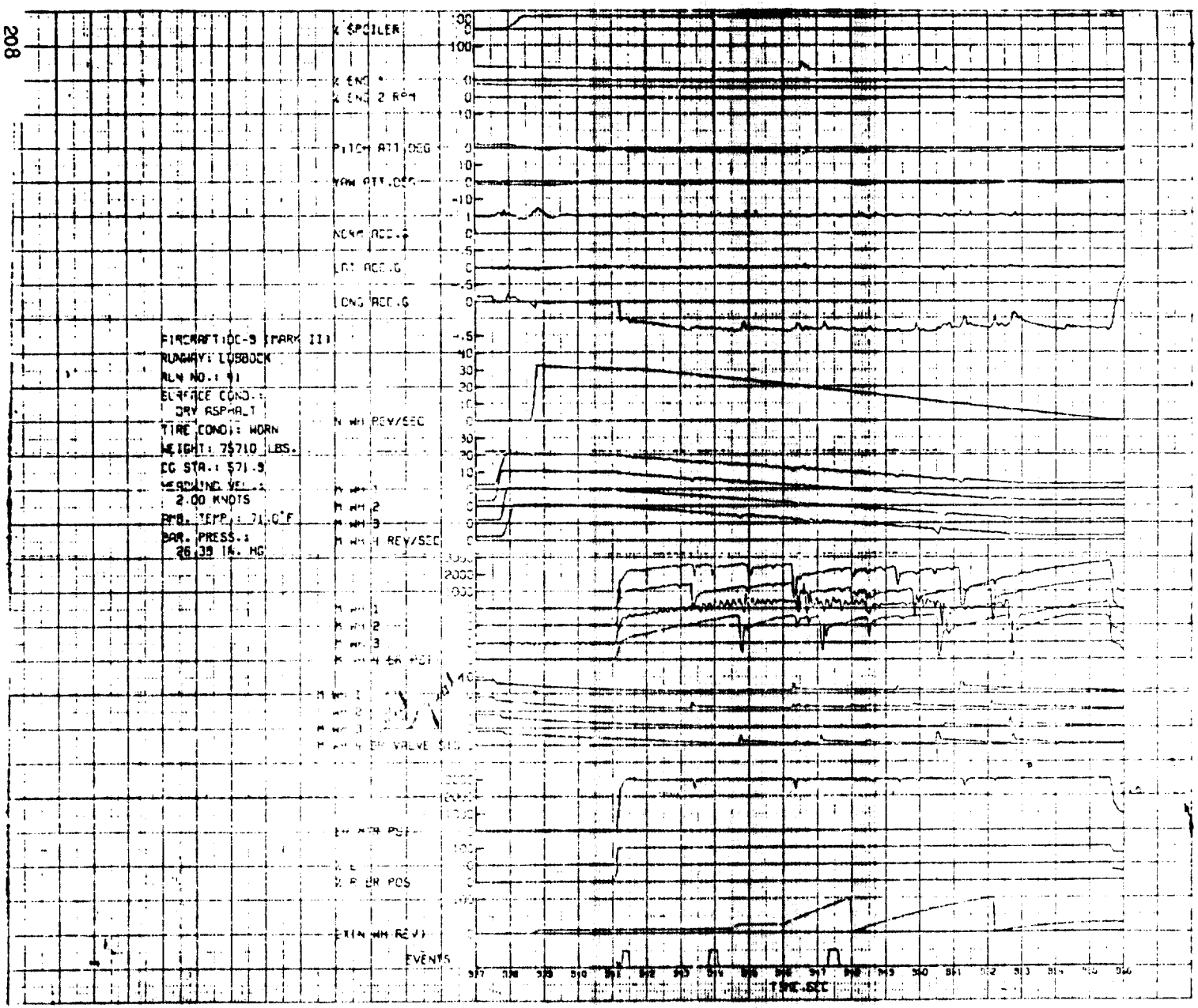

AVG FRICTION COEF
AVERAGE SLIP RATIO
RUNWAY: LUBBOCK
WH 1
WH 2
WH 3
WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
WH 1
WH 2
WH 3
WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC

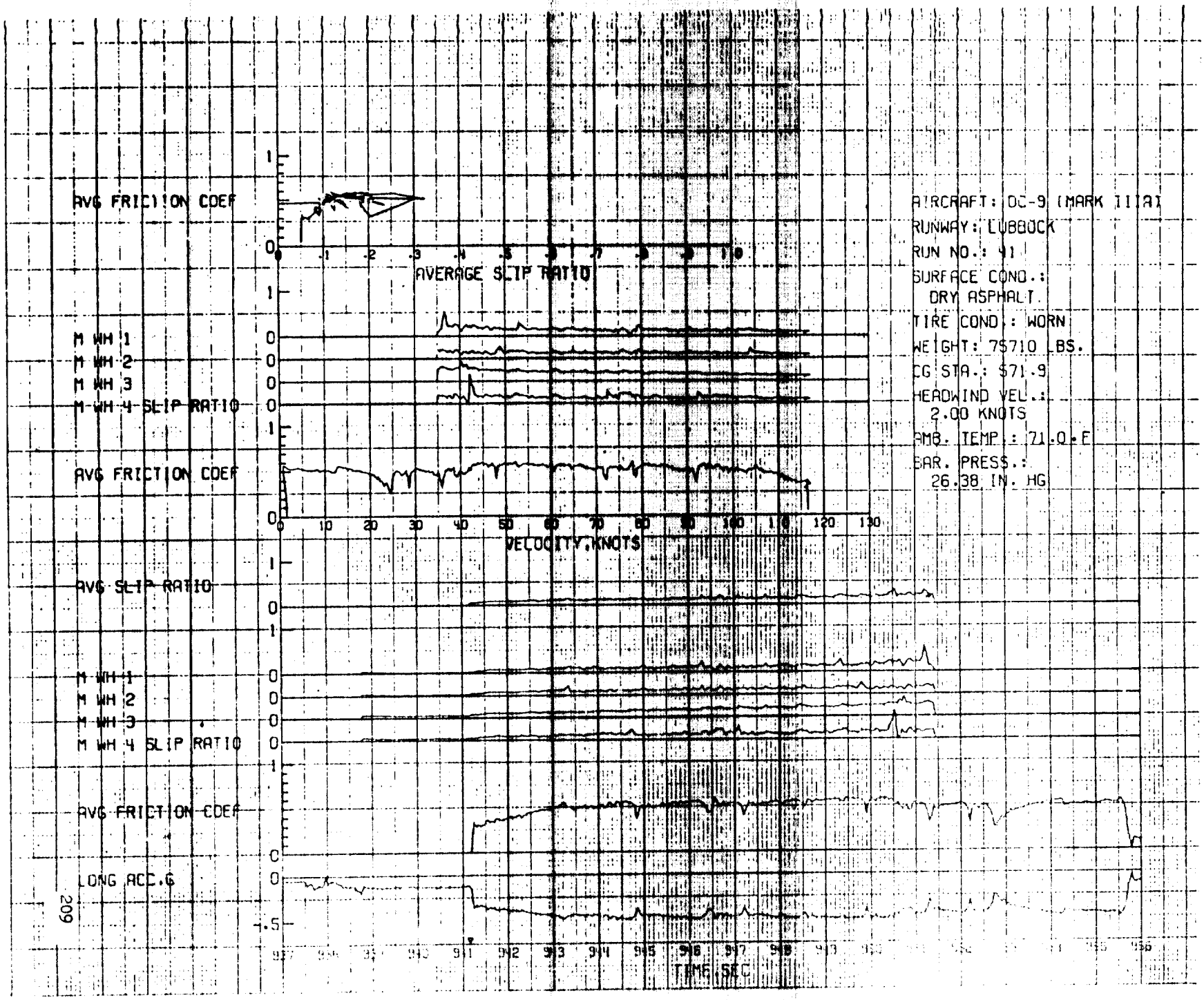

X SPOILER
PITCH ATT DEG
YAW ANG DEG
RUN NO.
SURFACE COND.
DRY ASPHALT
TIRE COND.
KEY: THRUST APPLIED
DURING RUN

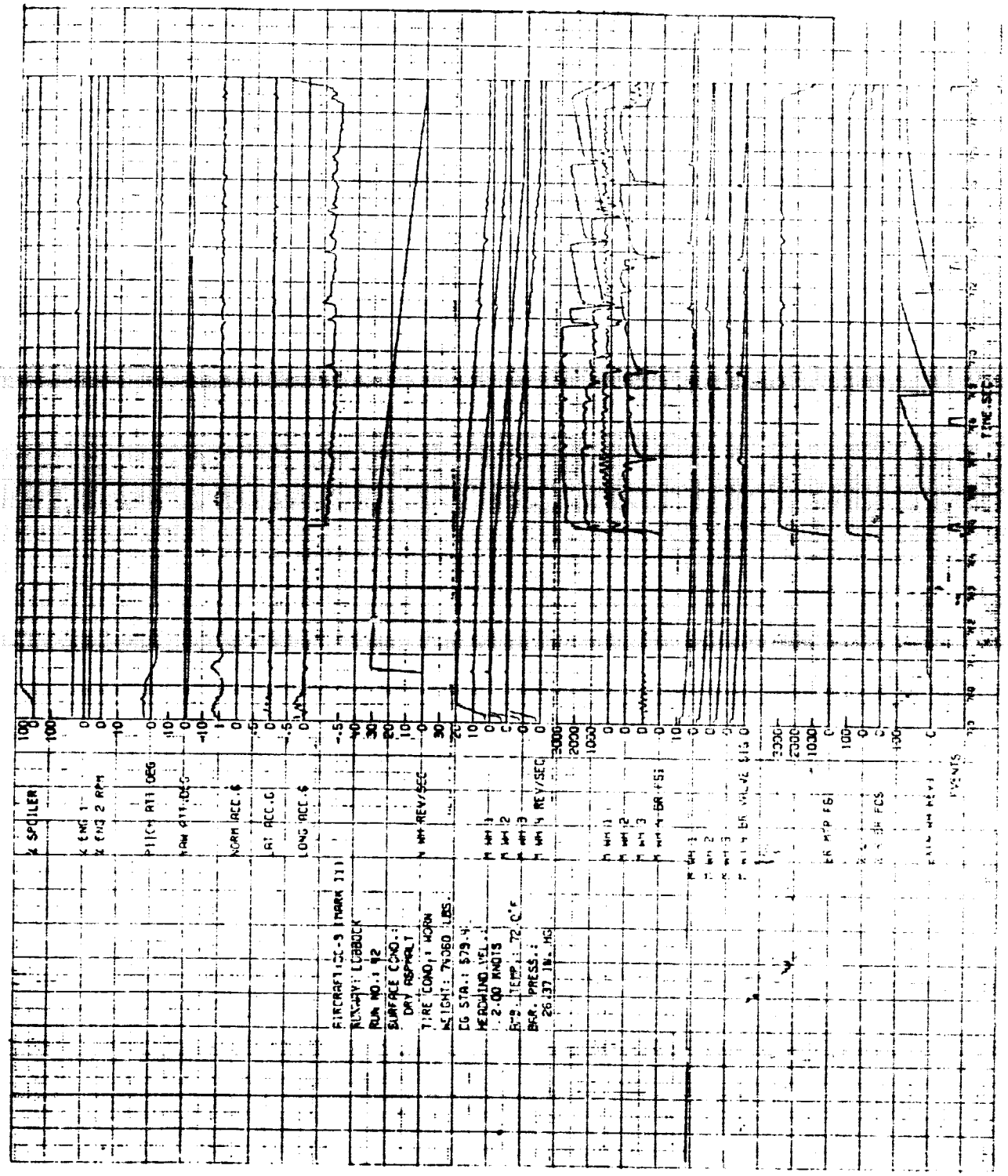

AVG FRICTION COEF
1
0
1
AVERAGE SLIP RATIO
VELOCITY,KNOTS
AVG SLIP RATIO
1
0
1
AVG FRICTION COEF
1
0
.5
0
307
308
309
310
311
TIME,SEC

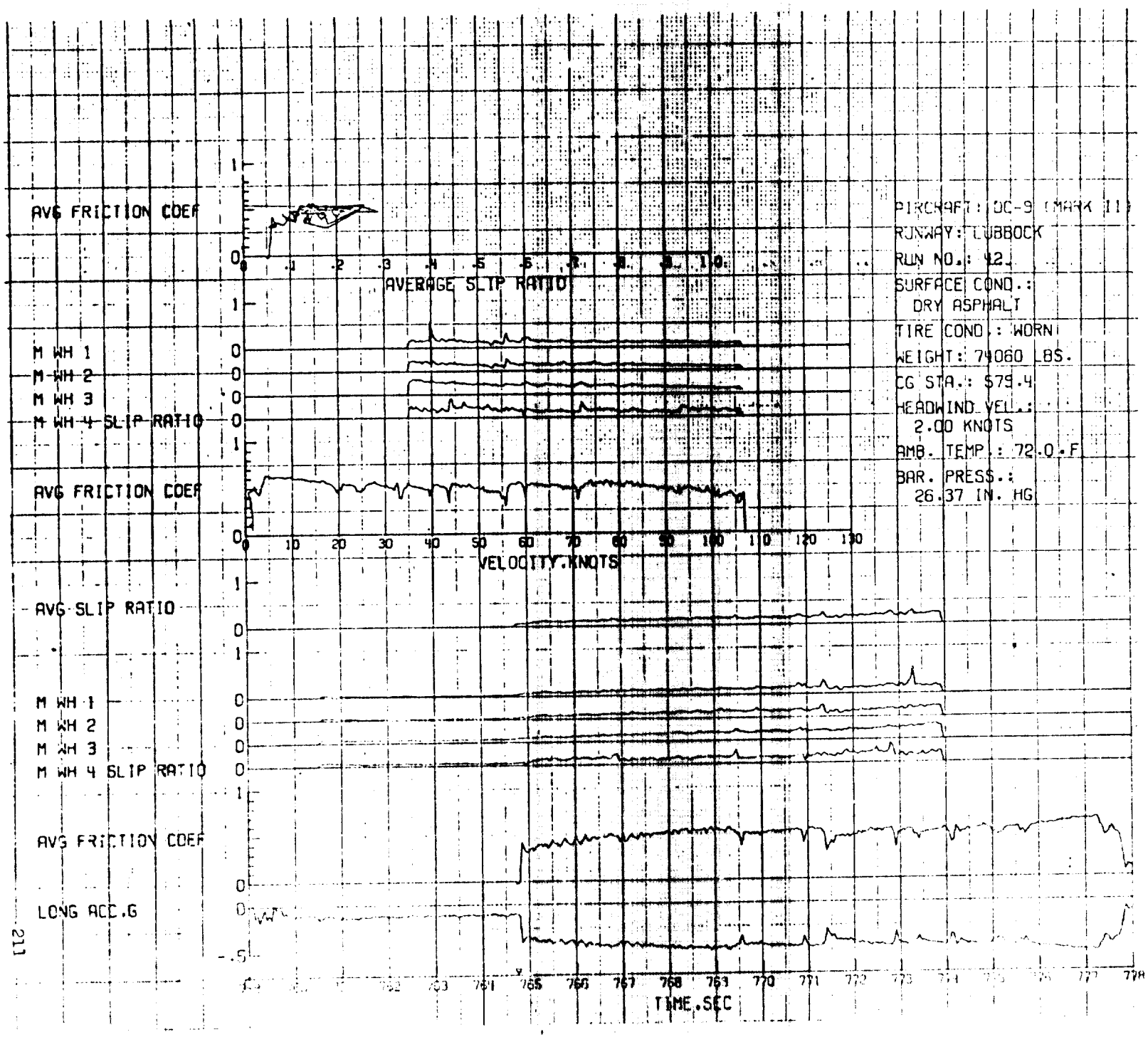

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
NORM ACC.G
TIME.SEC

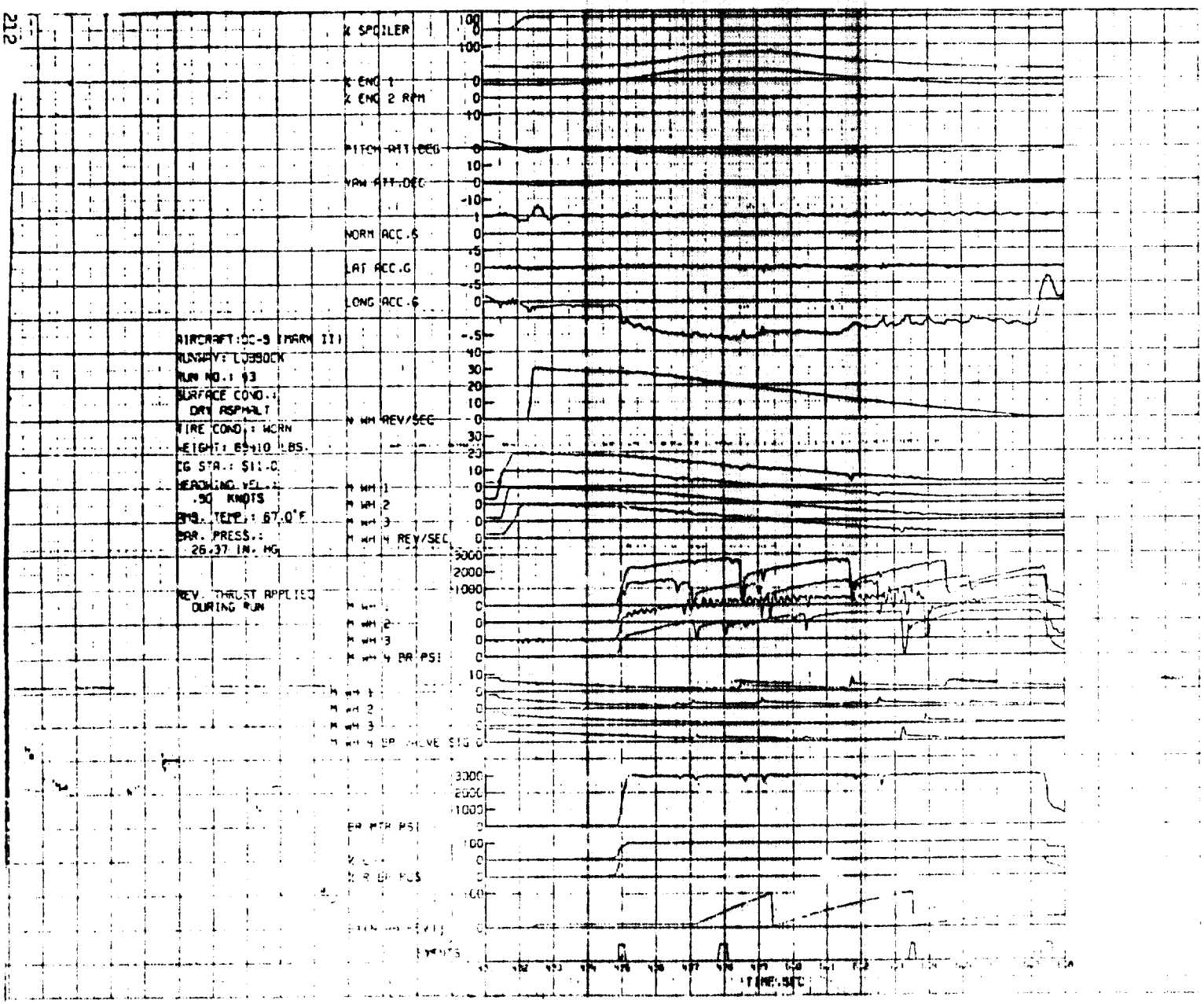

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: LUBBOCK
RUN NO.: 40
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 75930 LBS.
CG STA.: 880.0
HEADWIND VEL.:
5.10 KNOTS
AMB. TEMP.: 80.0 F
BAR. PRESS.:
26.46 IN. HG

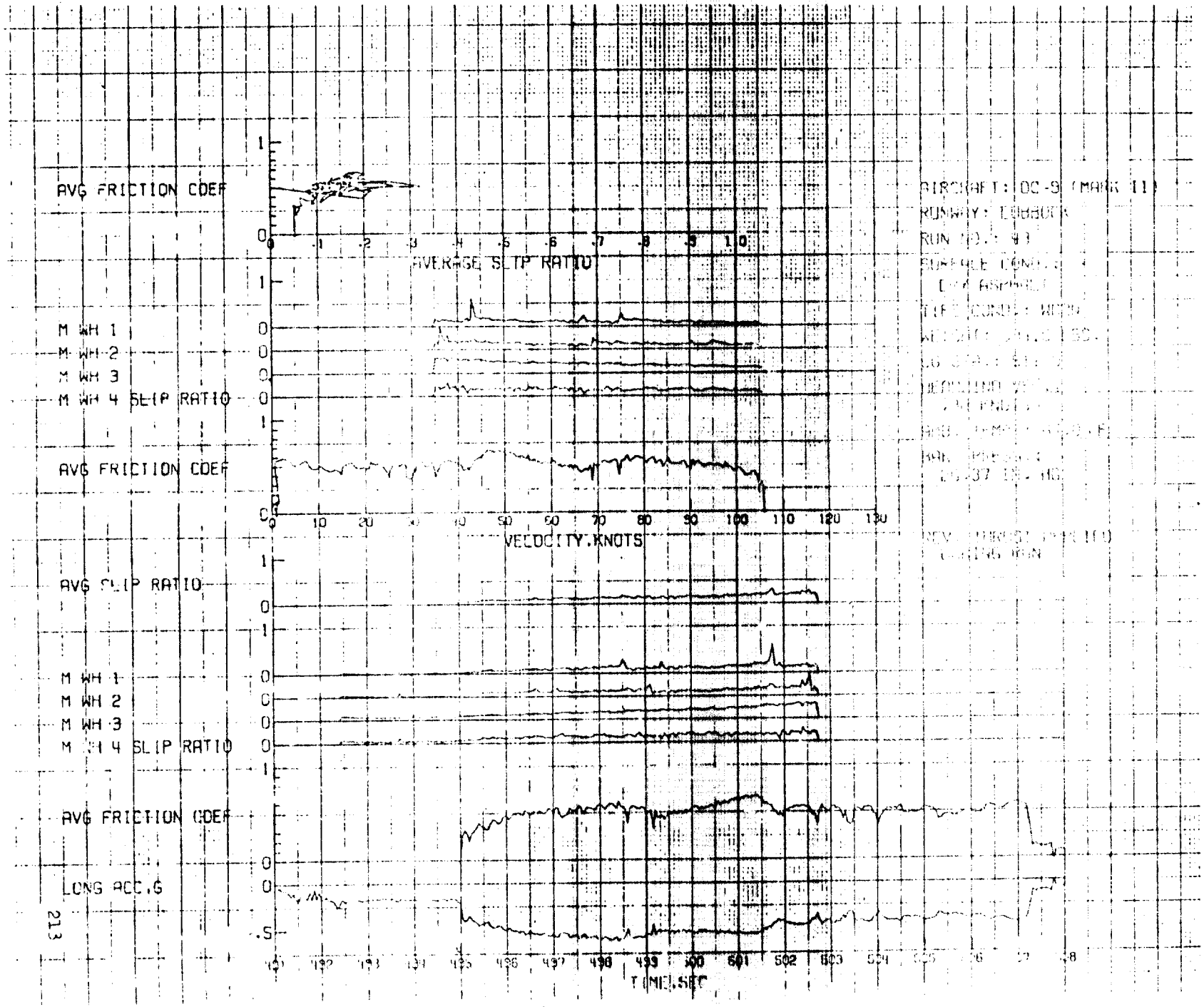

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT DEG
YAW ATT DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (MARK III)
RUNWAY: LUBBOCK
RUN NO.: 91
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 75710 LBS.
CG STA.: 571.9
HEADING VEL.:
2.00 KNOTS
AMB. TEMP.: 71.0°F
BAR. PRESS.:
26.39 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
EVENTS
TIME-SEC


AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK III)AI
RUNWAY: LUBBOCK
RUN NO.: 41
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 75710 LBS.
CG STA.: 571.9
HEADWIND VEL.:
2.00 KNOTS
AMB. TEMP.: 71.0 F
BAR. PRESS.:
26.38 IN. HG


% SPOILER
% ENG 1 RPM
% ENG 2 RPM
PITCH ATT DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT: SC-9 (MARK III)
RUNWAY: LUBBOCK
RUN NO.: 12
SURFACE COND.: DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 79060 LBS.
CG STA.: 579.4
HEADWIND VEL.: 2.00 KNOTS
AIR TEMP.: 72.0°F
BAR. PRESS.: 26.37 IN. HG
TIME,SEC

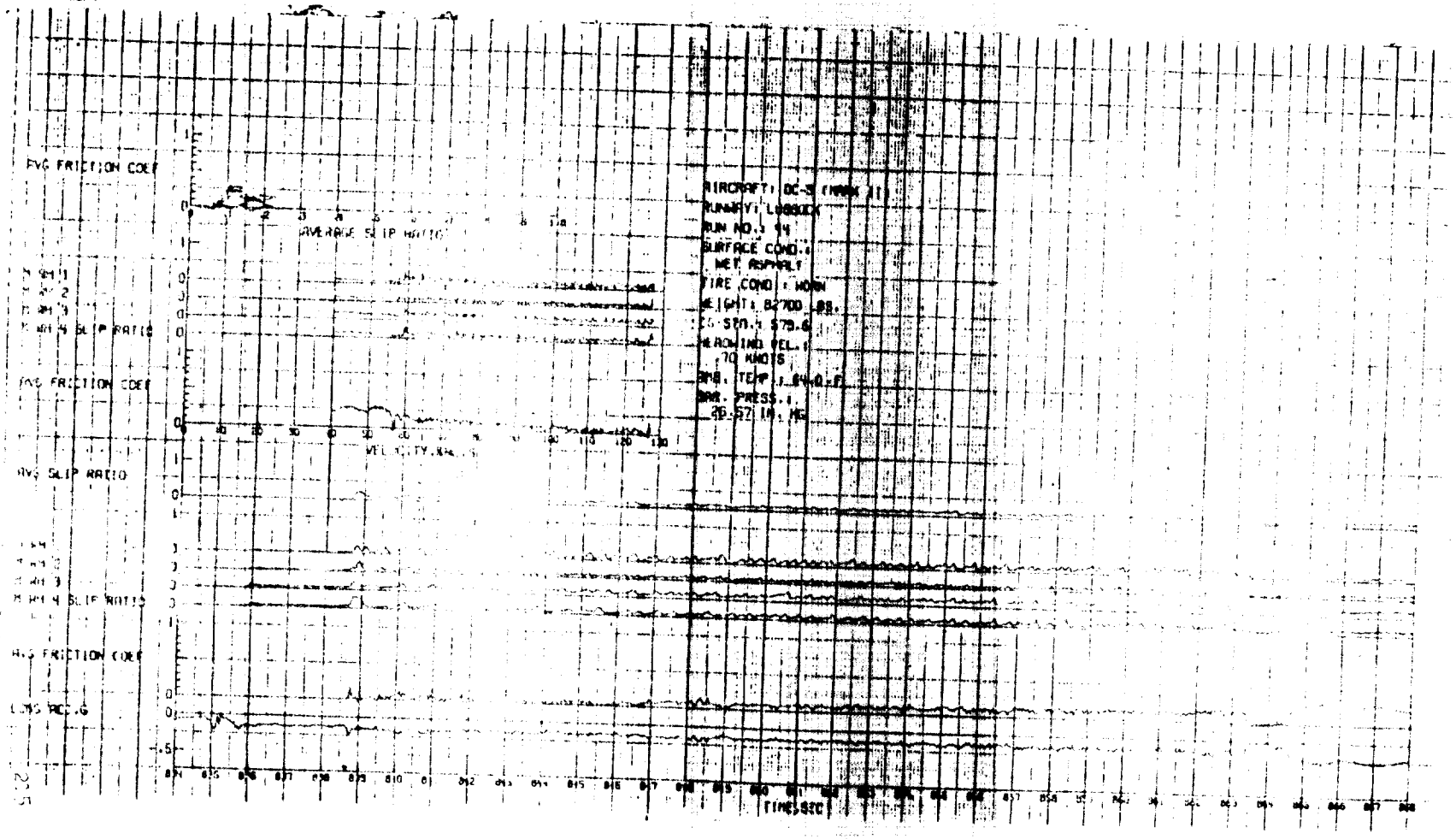

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AIRCRAFT: DC-9 (MARK II)
RUNWAY: LUBBOCK
RUN NO.: 42
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 74060 LBS.
CG STA.: 879.4
HEADWIND VEL.:
2.00 KNOTS
AMB. TEMP.: 72.0 F
BAR. PRESS.:
26.37 IN. HG
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC


% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT DEG
YAW ATT DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT: CC-9 (MARK III)
RUNWAY: LUBBOCK
RUN NO.: 13
SURFACE COND.: DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 69410 LBS.
CG STA.: 511.0
HEADING VEL.: 90 KNOTS
AMB. TEMP.: 67.0°F
BAR. PRESS.: 26.37 IN. HG
REV. THRUST APPLIED DURING RUN
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 4 BR PSI
BR PTR PSI
TIME SEC

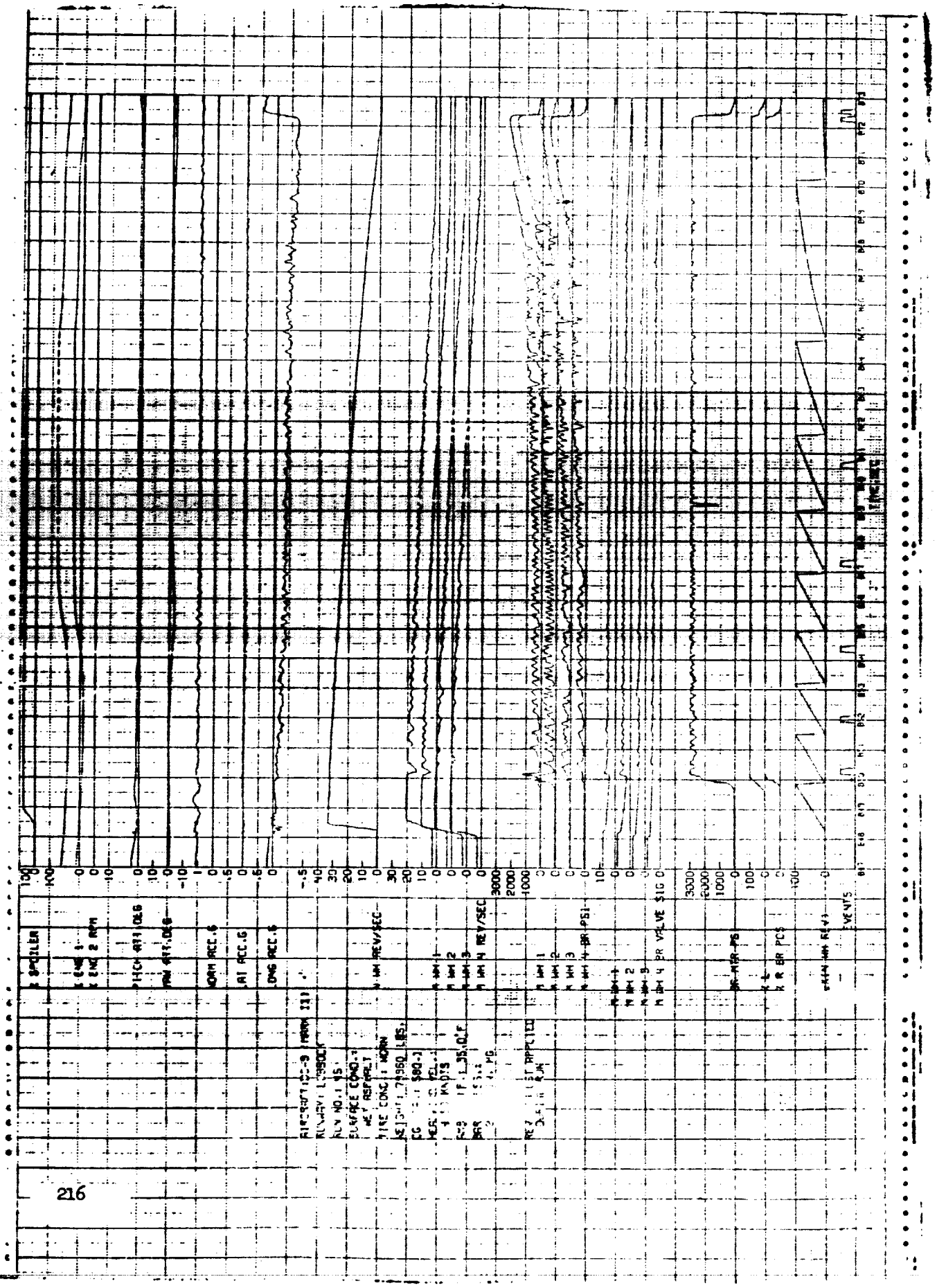


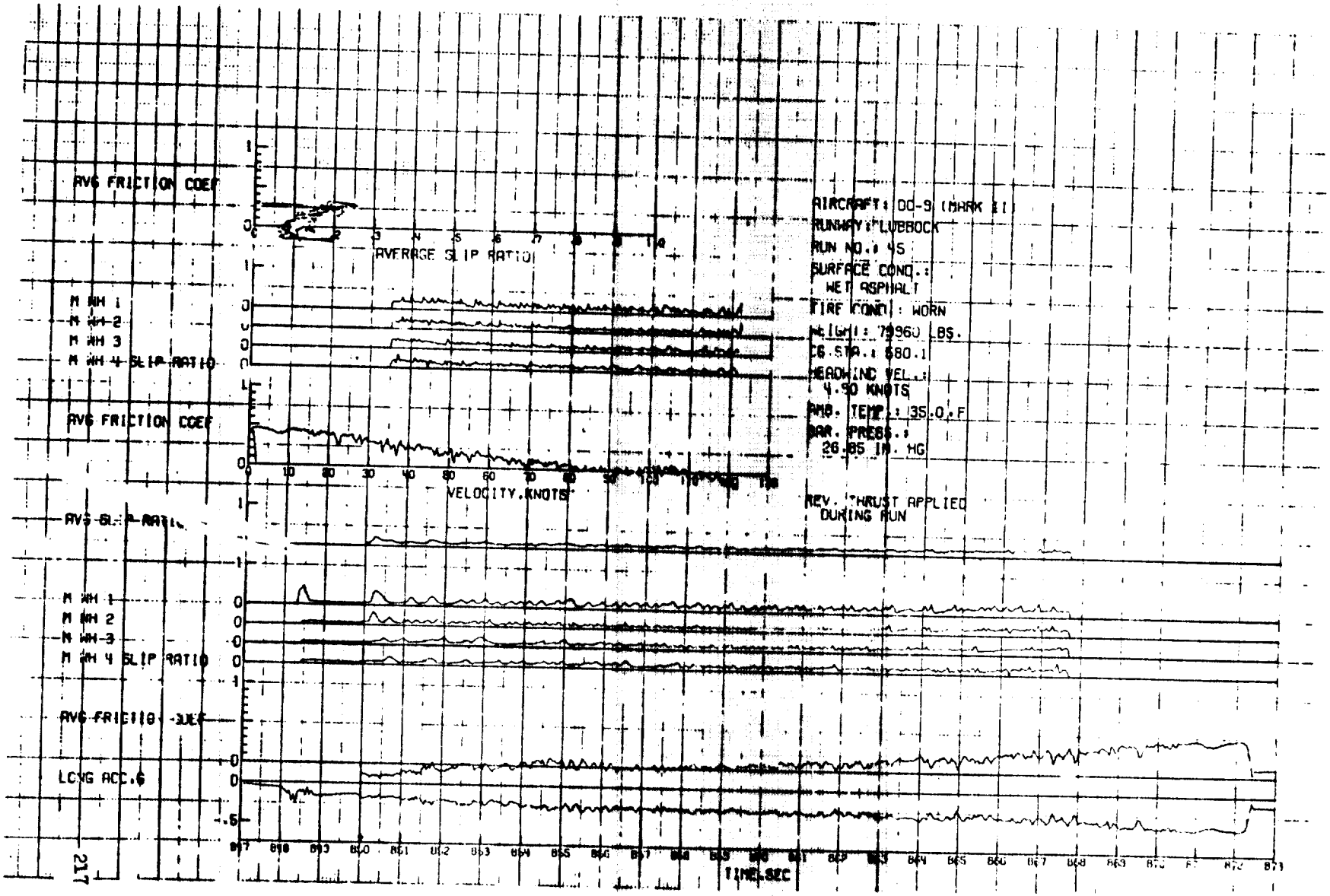
REPRODUCIBILITY OF THE
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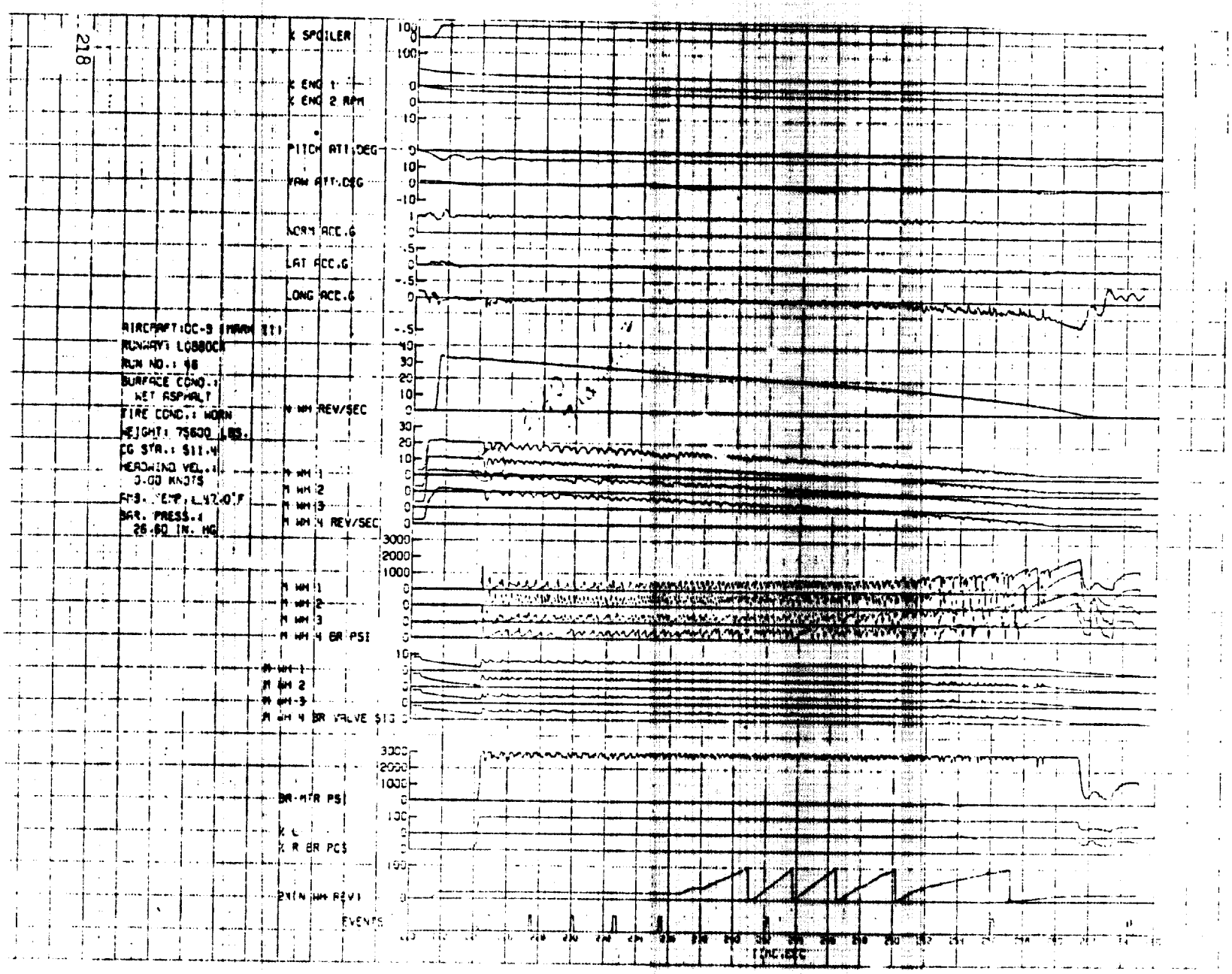
AIRCRAFT: OC-9 (NASA 11)
RUN NO.: 69
SURFACE COND.: WET ASPHALT
TIRE COND.: NEW
WEIGHT: 87,000 LBS.
CG STA.: 573.6
HEADWIND VEL.: 70 KNOTS
AMB. TEMP.: 86°F
BAR. PRESS.: 28.857 IN. HG
NORM ACC.'S
LAT ACC.'S
LONG ACC.'S
EVENTS

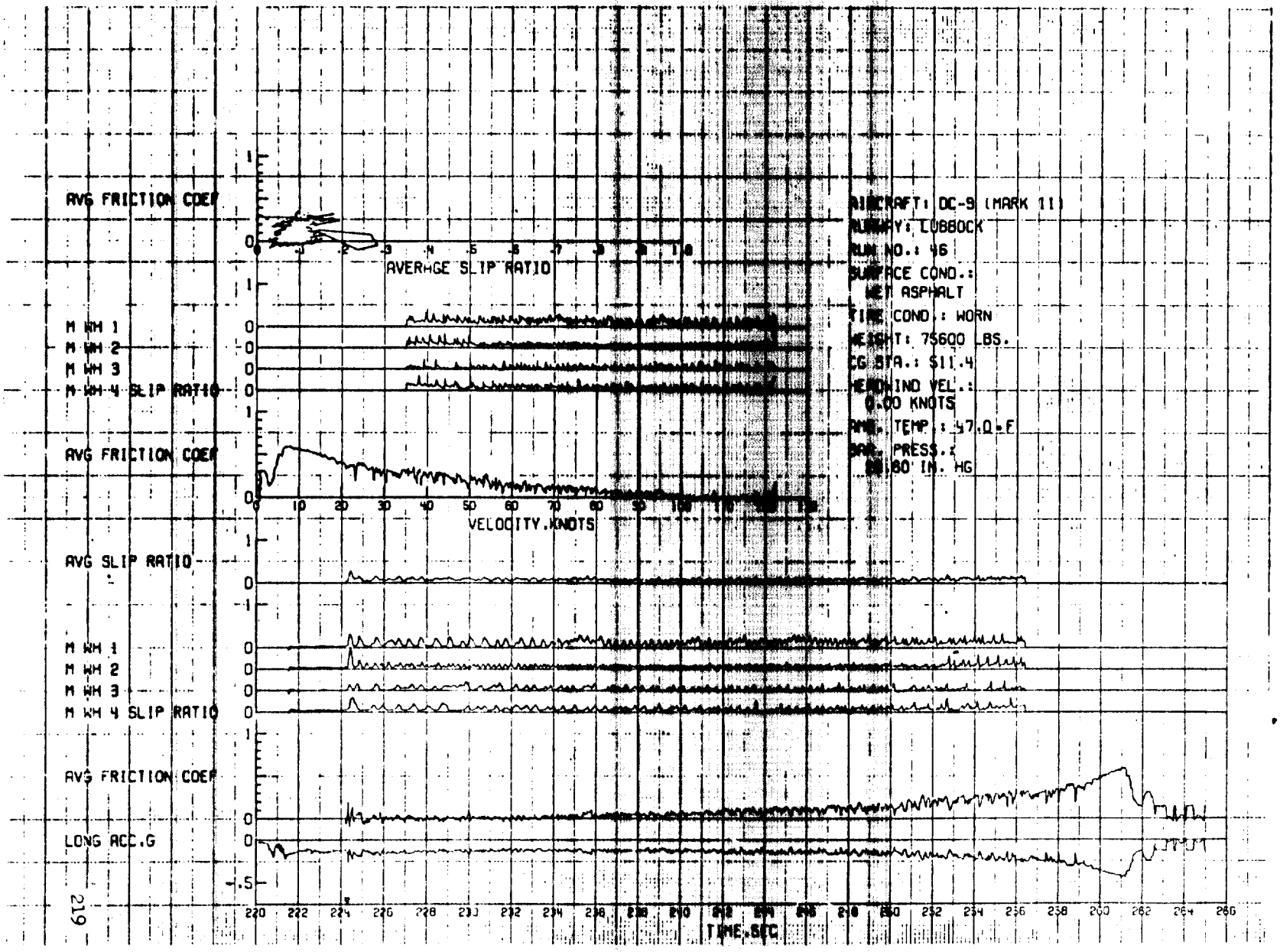

AVG FRICTION COEF
AVERAGE SLIP RATIO
AIRCRAFT: DC-9
RUNWAY: LOGBOOK
RUN NO.: 14
SURFACE COND.:
WET ASPHALT
TIRE COND.: WORN
WEIGHT: 82700 LBS.
HEADWIND COMP.:
70 KNOTS
AMB. TEMP.: 84.0 F
BAR. PRESS.:
29.52 IN. HG
AVG SLIP RATIO
TIME SEC

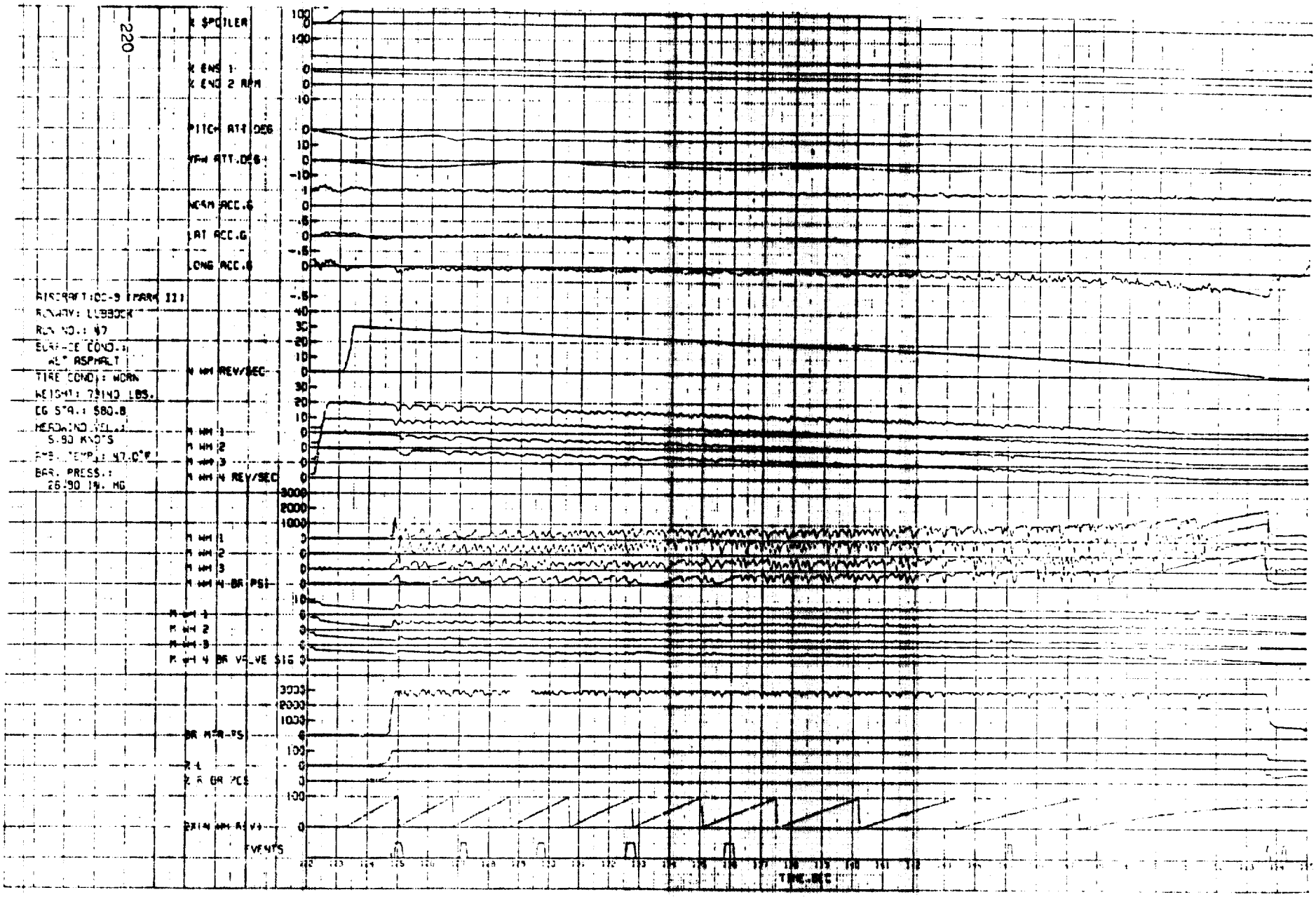
REPRODUCIBILITY OF THE
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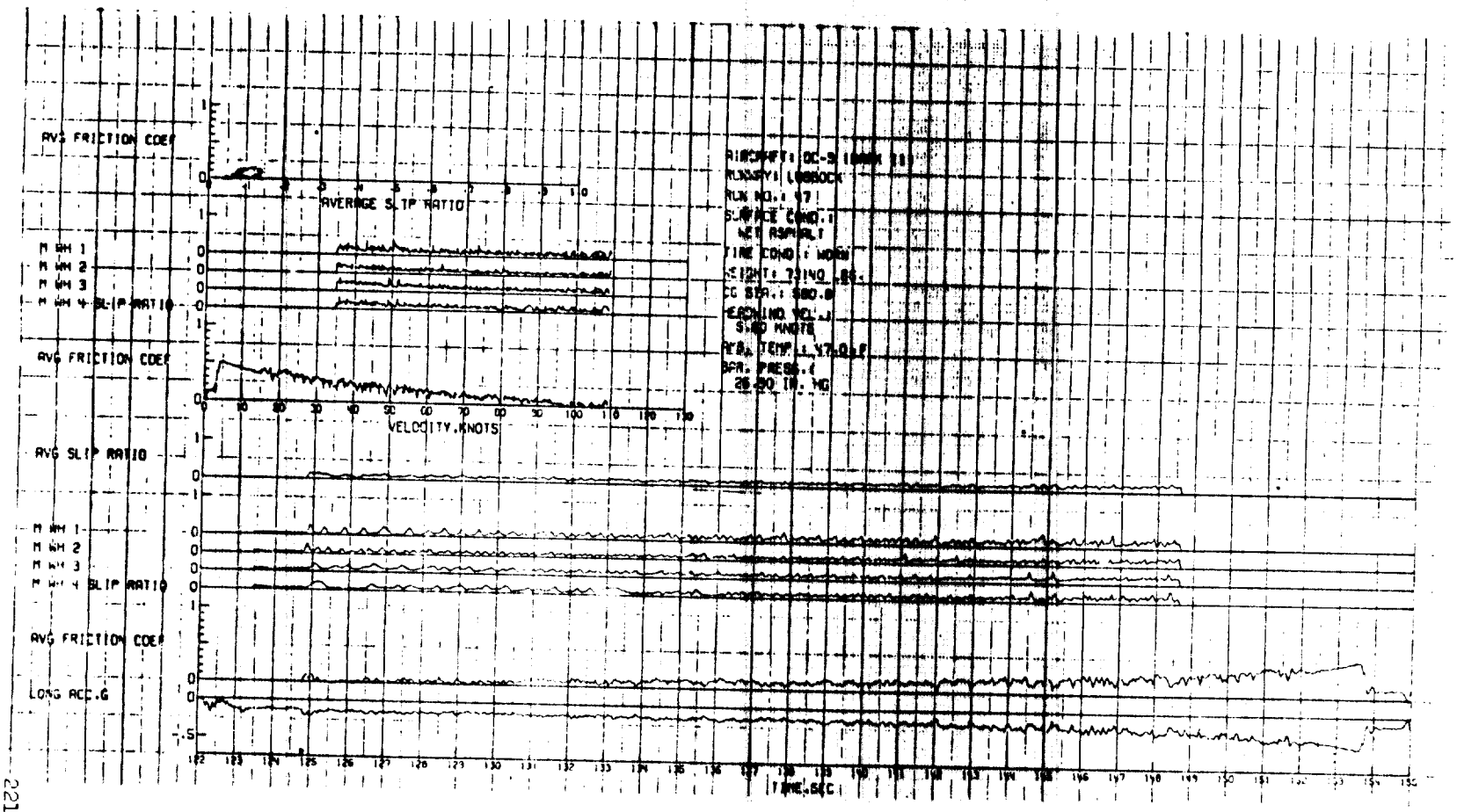


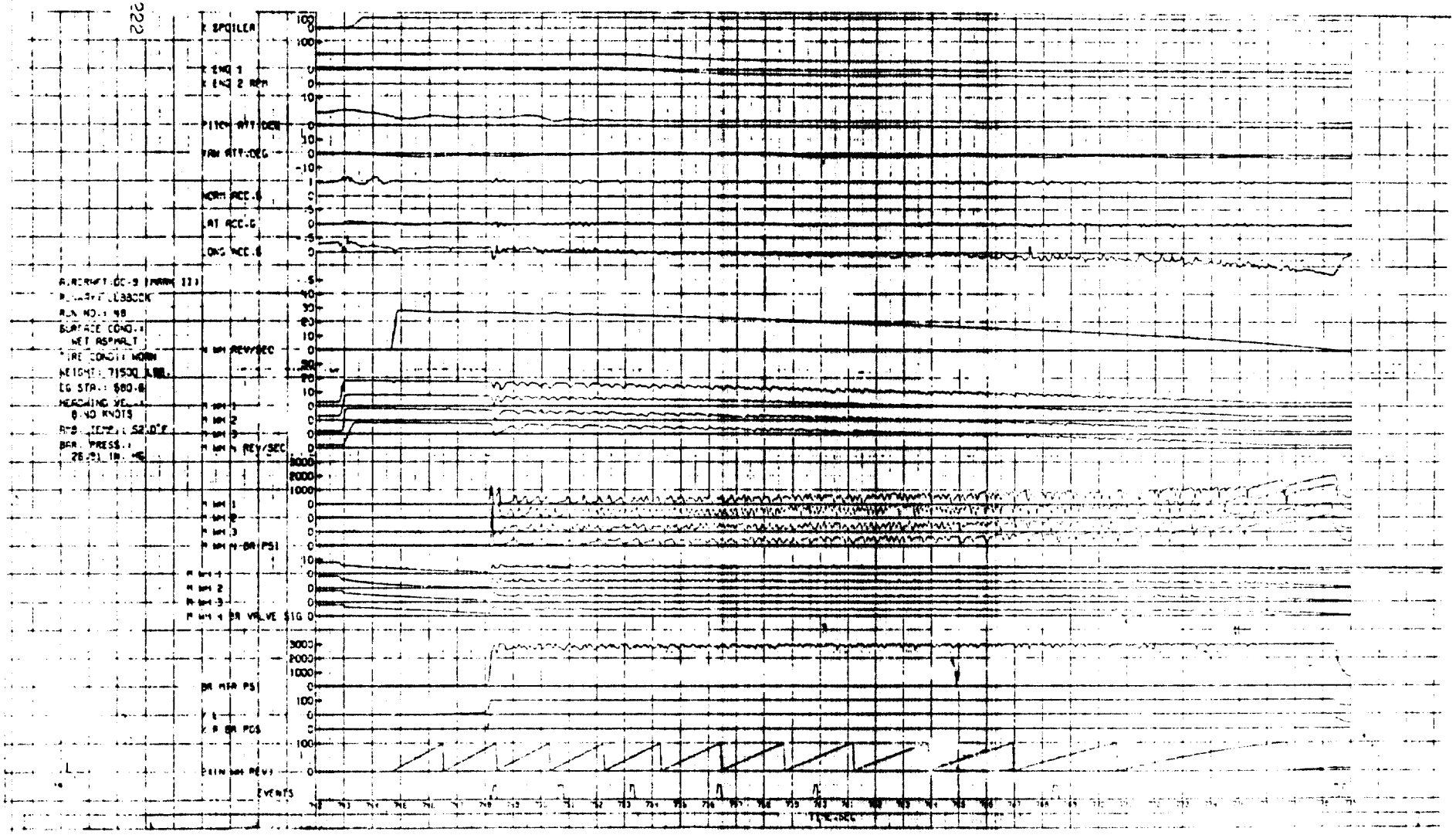

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY, KNOTS
AIRCRAFT: DC-9 (MARK II)
RUNWAY: LUBBOCK
RUN NO.: 45
SURFACE COND.:
WET ASPHALT
TIRE COND.: WORN
WEIGHT: 79960 LBS.
CG STA.: 680.1
HEADWIND VEL.:
4.90 KNOTS
AMB. TEMP.: 35.0 F
BAR. PRESS.:
26.85 IN. HG
REV. THRUST APPLIED
DURING RUN
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME, SEC


218
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:OC-9
RUNWAY: LGB30C
RUN NO.: 98
SURFACE COND.:
WET ASPHALT
TIRE COND.: WORN
WEIGHT: 75600 LBS.
CG STA.: 511.4
HEADWIND VEL.:
3.00 KNOTS
BAR. PRESS.:
28.80 IN. HG
TIME,SEC

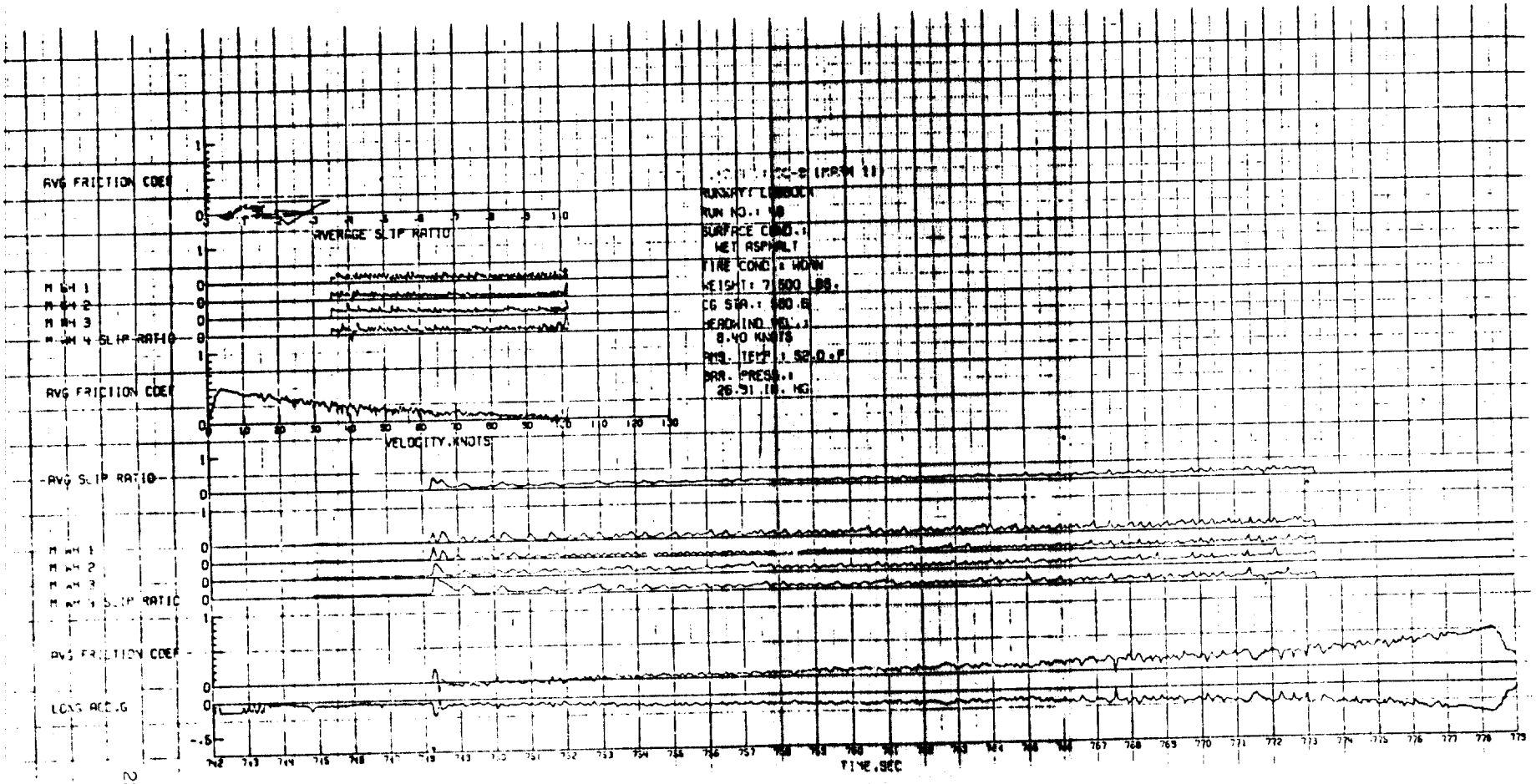

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC
AIRCRAFT: DC-9 (MARK 11)
RUNWAY: LUBBOCK
RUN NO.: 46
SURFACE COND.:
WET ASPHALT
TIRE COND.: WORN
WEIGHT: 75600 LBS.
CG STA.: 511.4
HEADWIND VEL.:
0.00 KNOTS
AMB. TEMP.: 47.0 F
BAR. PRESS.:
30.80 IN. HG

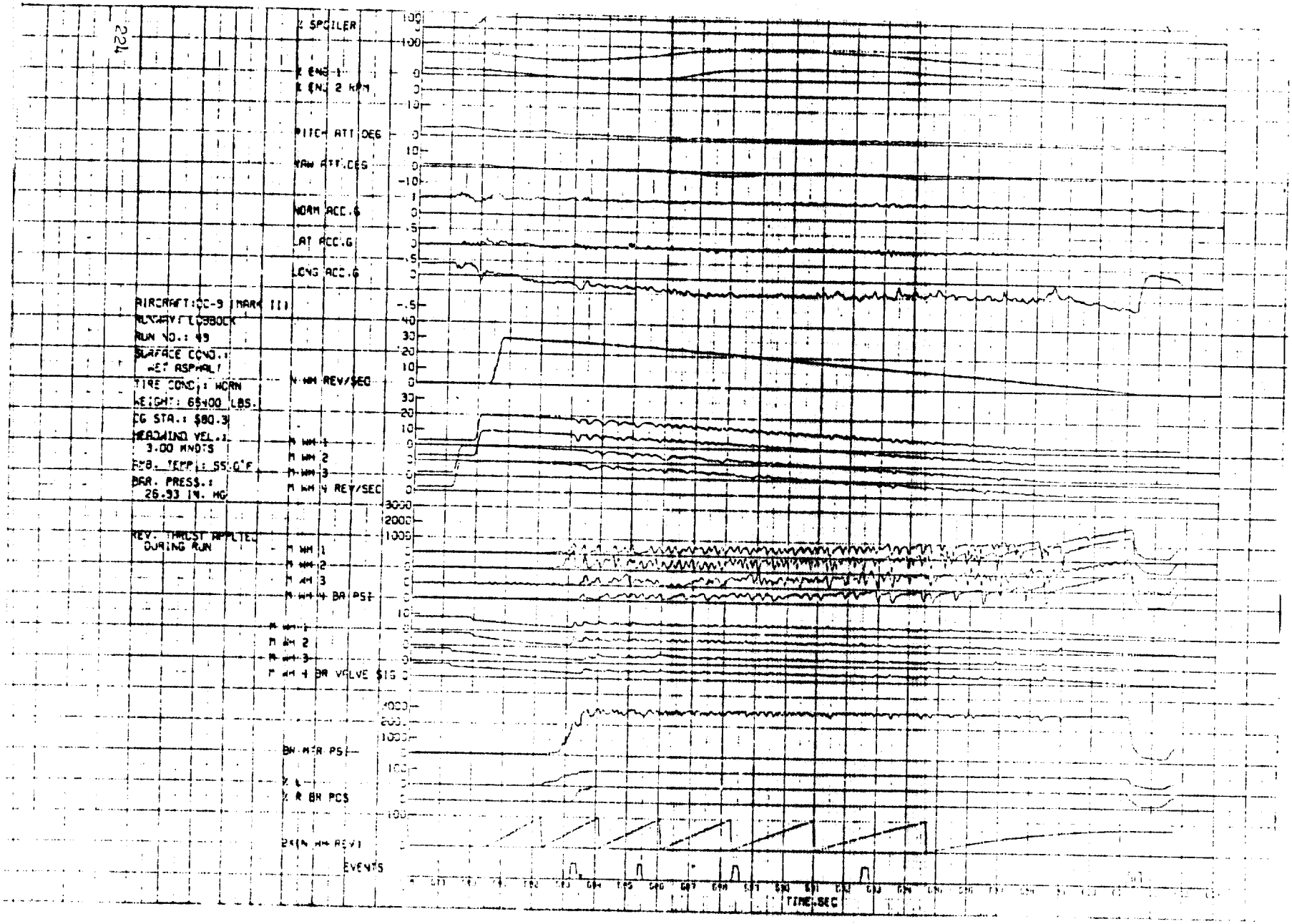

220
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (PARK II)
AIRWAY: LUBBOCK
RUN NO.: 67
SURFACE COND.:
40° ASPHALT
TIRE COND.: WORN
WEIGHT: 73140 LBS.
CG STA.: 880.8
HEADWIND VEL.:
5.90 KNOTS
AIR TEMP.: 97.0°F
BAR. PRESS.:
28.90 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH N REV/SEC
N WH 1
N WH 2
N WH 3
N WH N BR PSI
N WH 1
N WH 2
N WH 3
N WH N BR VALVE SIG
BR MSR-PS
% BR POS
EXIN WH REVS
EVENTS
TIME,SEC

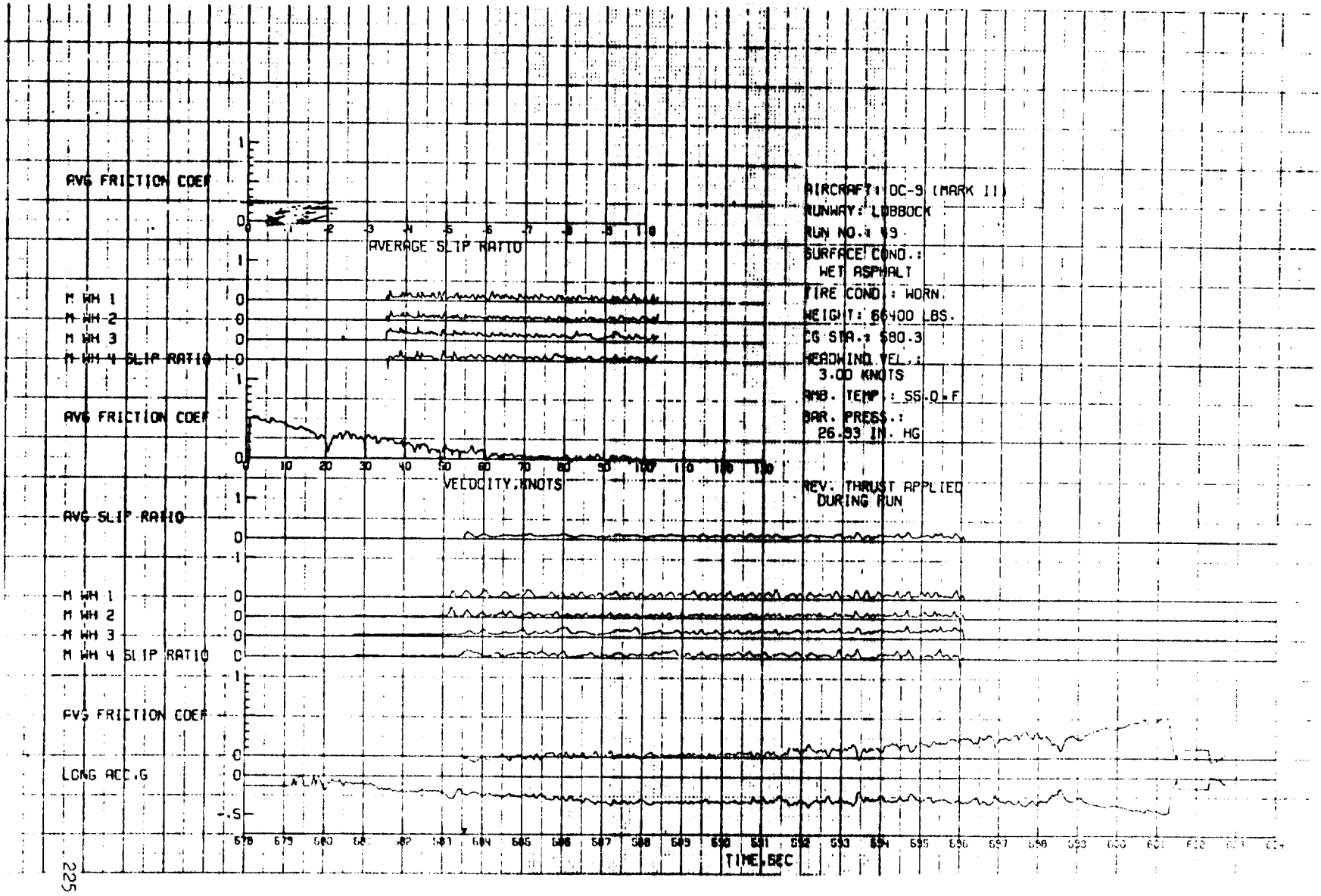

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC

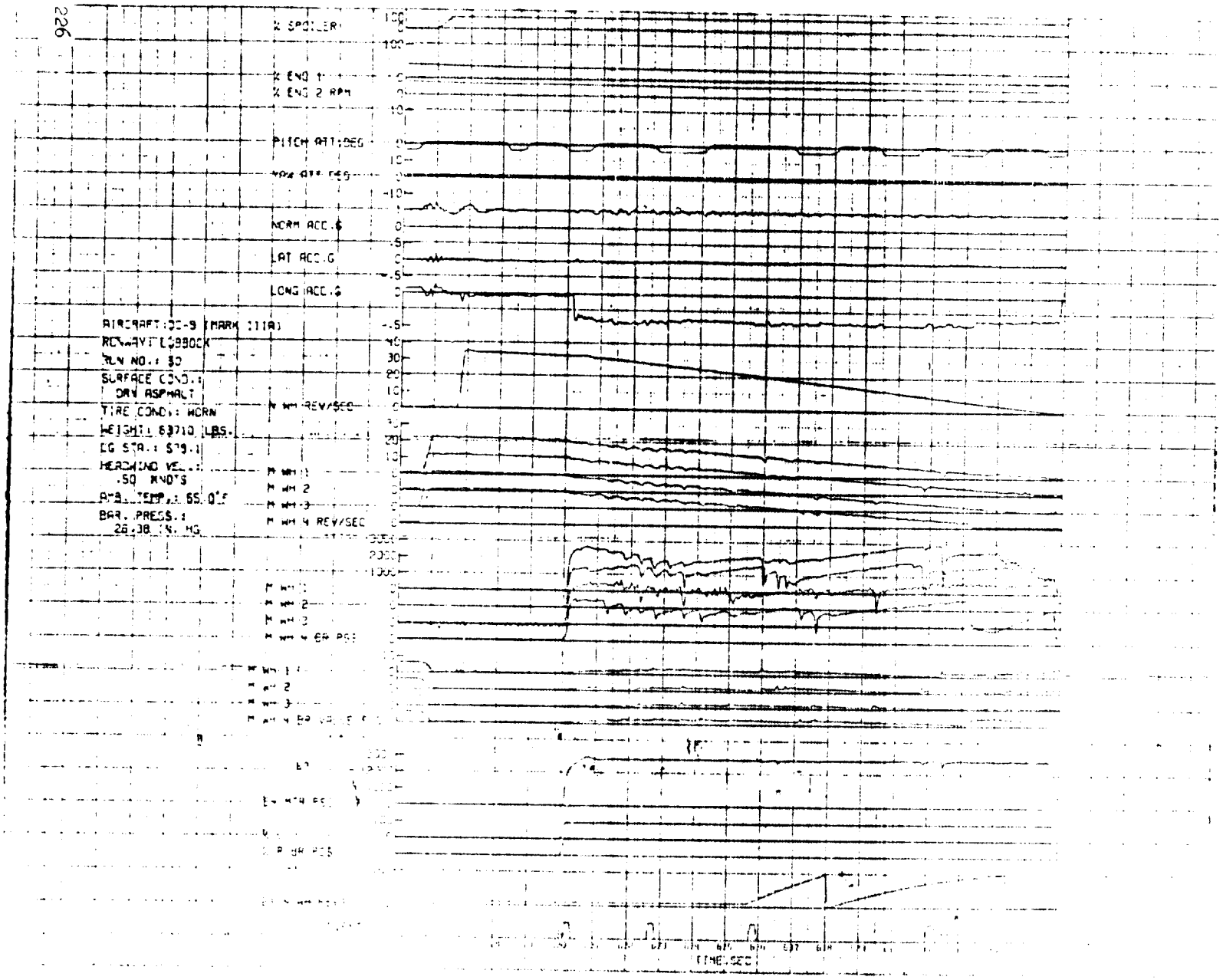

SPOILER
ENG 1
ENG 2 RPM
PITCH ATT-DEG
YAW ATT-DEG
NORM ACC-G
LAT ACC-G
LONG ACC-G
AIRCRAFT: DC-9 (MRM II)
RUNWAY: LUBBOCK
RUN NO.: 98
SURFACE COND.: WET ASPHALT
TIRE CONDITION: WORN
WEIGHT: 71500 LBS.
CG STA.: 880.8
HEADING VE... 0 KNOTS
WIND: [illegible] 320°
BAR. PRESS.: 28.91 IN. HG
REV/SEC
N-BR PSI
BR VALVE SIG
BR MSR PSI
BRK PCS
EVENTS
TIME-SEC

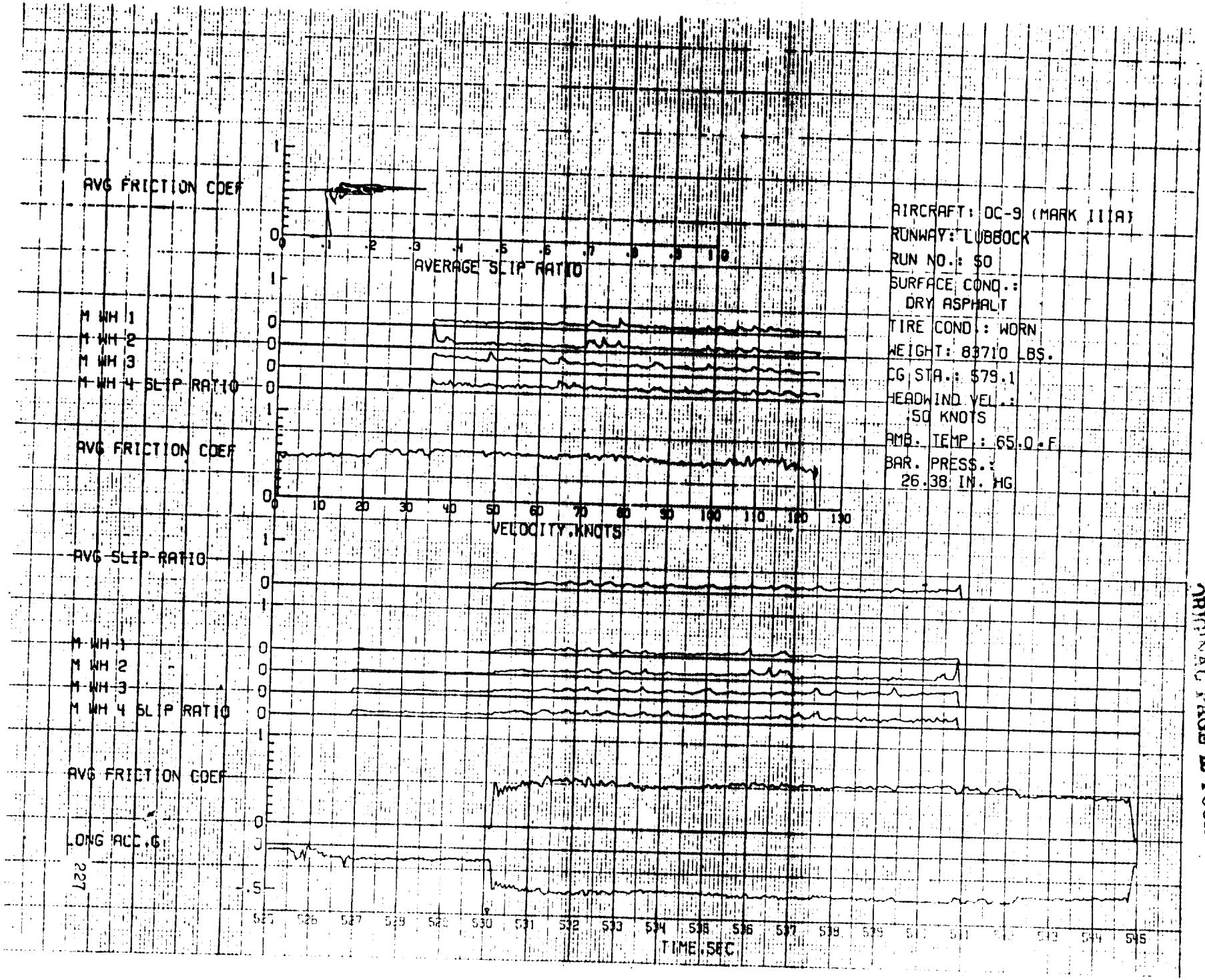
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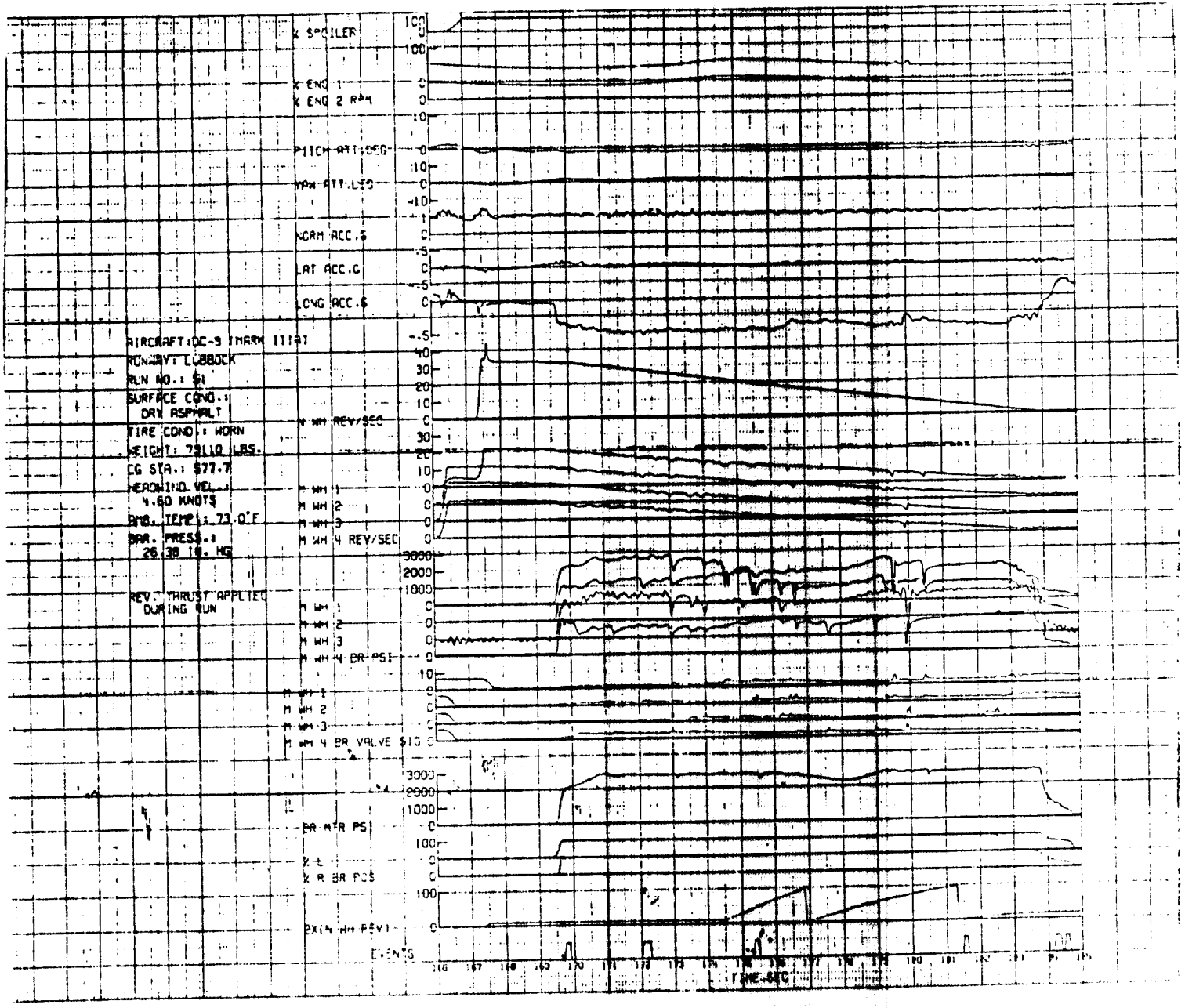

224
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-9 (MARK III)
RUNWAY:LUBBOCK
RUN NO.: 49
SURFACE COND.: WET ASPHALT
TIRE COND.: WORN
WEIGHT: 65400 LBS.
CG STA.: 880.3
HEADWIND VEL.: 3.00 KNOTS
AMB. TEMP.: 55.0°F
BAR. PRESS.: 26.93 IN. HG
REV. THRUST APPLIED DURING RUN
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE $IG
BR MSR PS
% L
% R BR POS
2*(N WH REV)
EVENTS
TIME,SEC

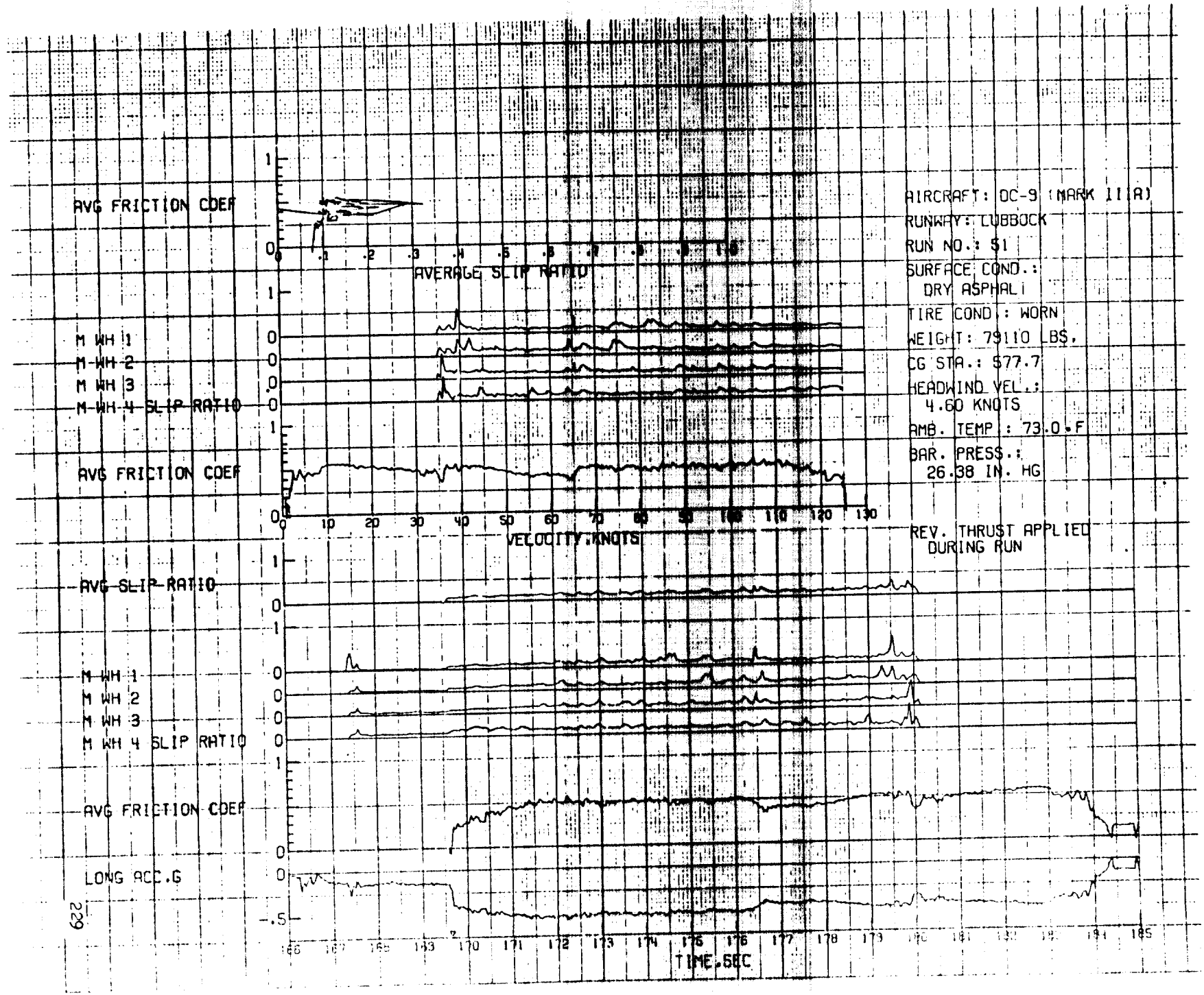

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY, KNOTS
AIRCRAFT: DC-9 (MARK II)
RUNWAY: LUBBOCK
RUN NO.: 69
SURFACE COND.: WET ASPHALT
TIRE COND.: WORN
WEIGHT: 86400 LBS.
CG STA.: 880.3
HEADWIND VEL.: 3.00 KNOTS
AMB. TEMP: 55.0 F
BAR. PRESS.: 26.93 IN. HG
REV. THRUST APPLIED DURING RUN
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME, SEC


% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.:DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (MARK III)
RUNWAY:LUBBOCK
RUN NO.: 30
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 63710 LBS.
CG STA.: 879.1
HEADWIND VEL.:
50 KNOTS
AMB. TEMP.: 65.0°F
BAR. PRESS.:
28.38 IN. HG
TIME,SEC

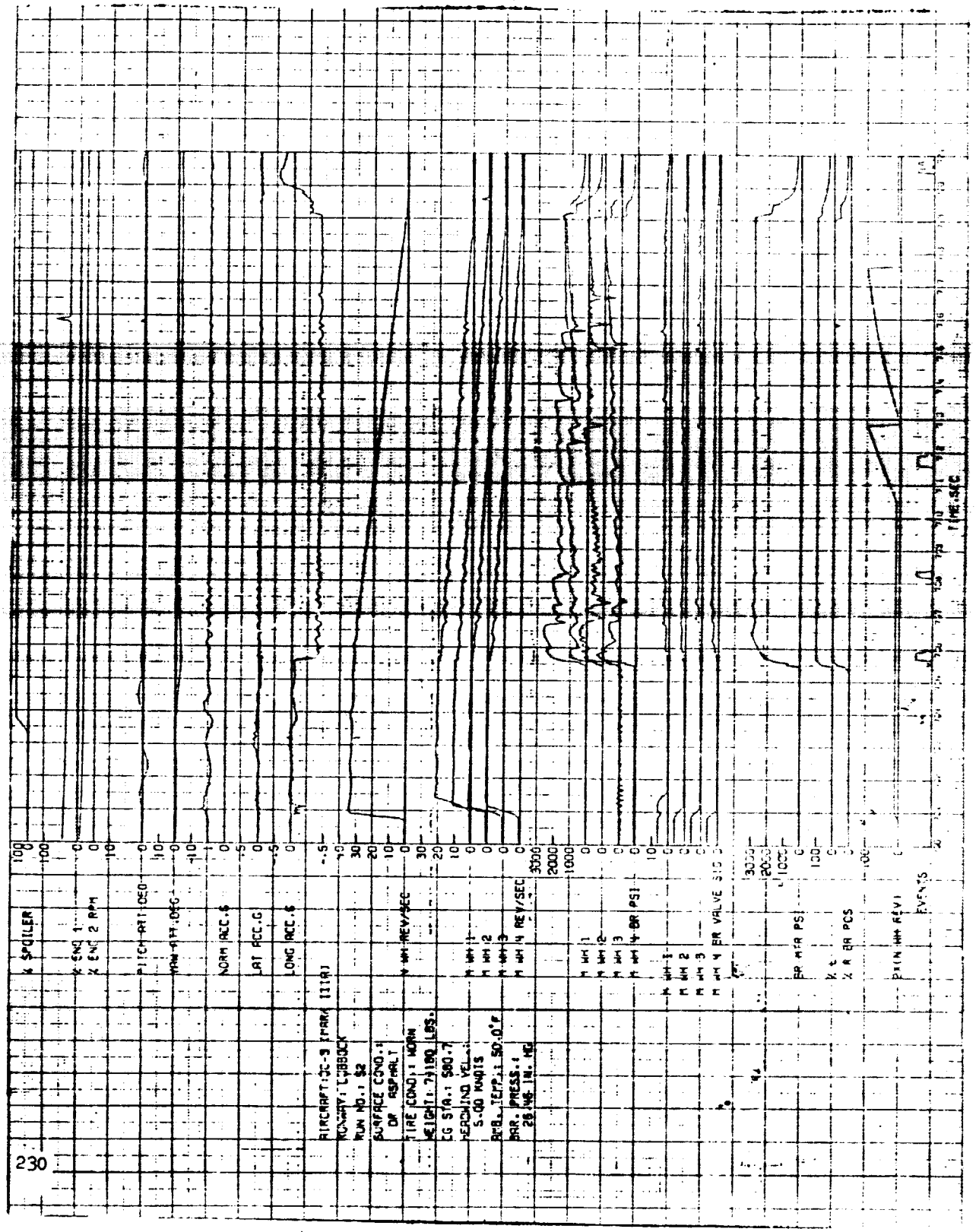


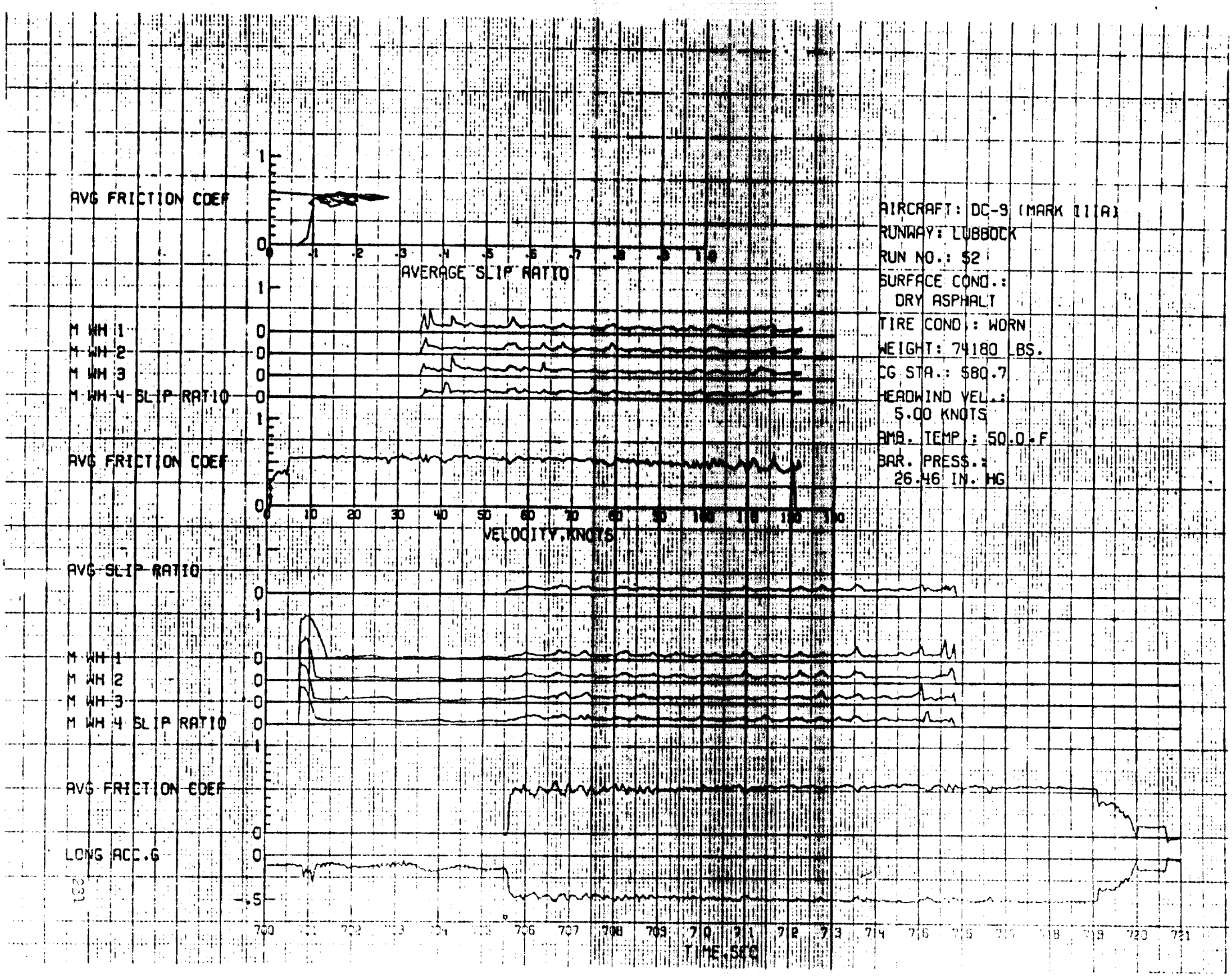
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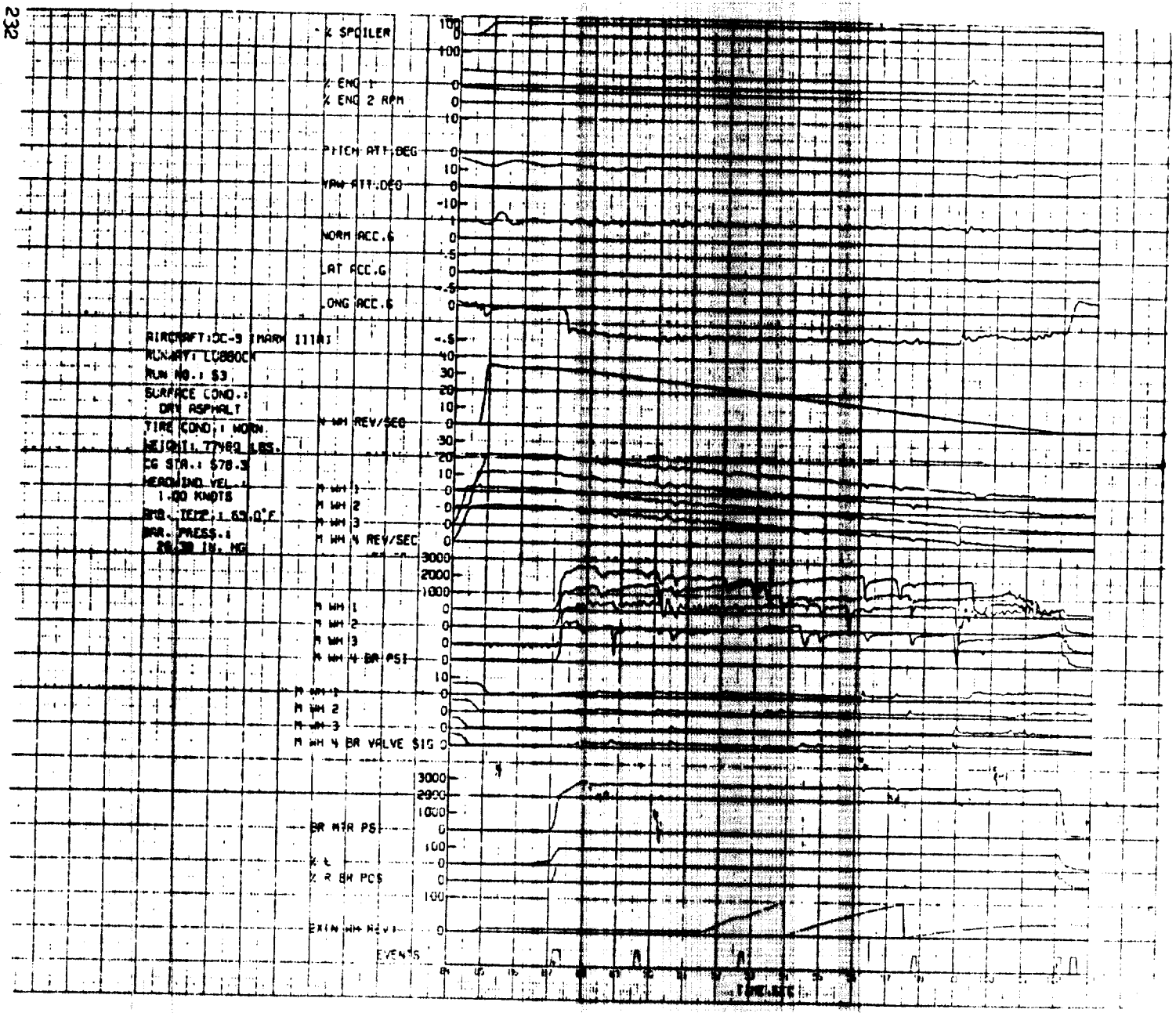

% SPOILER
% ENG 1 RPM
% ENG 2 RPM
PITCH ATT.DEG
MAN ATT.LEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:OC-9 (MARK III)
RUNWAY: LUBBOCK
RUN NO.: 51
SURFACE COND.: DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 79110 LBS.
CG STA.: 577.7
HEADWIND VEL.: 4.60 KNOTS
AMB. TEMP.: 73.0°F
BAR. PRESS.: 26.38 IN. HG
REV. THRUST APPLIED DURING RUN
M WH REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 BR PSI
M WH 1
M WH 2
M WH 3
M WH 4 BR VALVE SIG
BR MTR PSI
% L BR POS
% R BR POS
PXIN WH REV
EVENTS
TIME-SEC

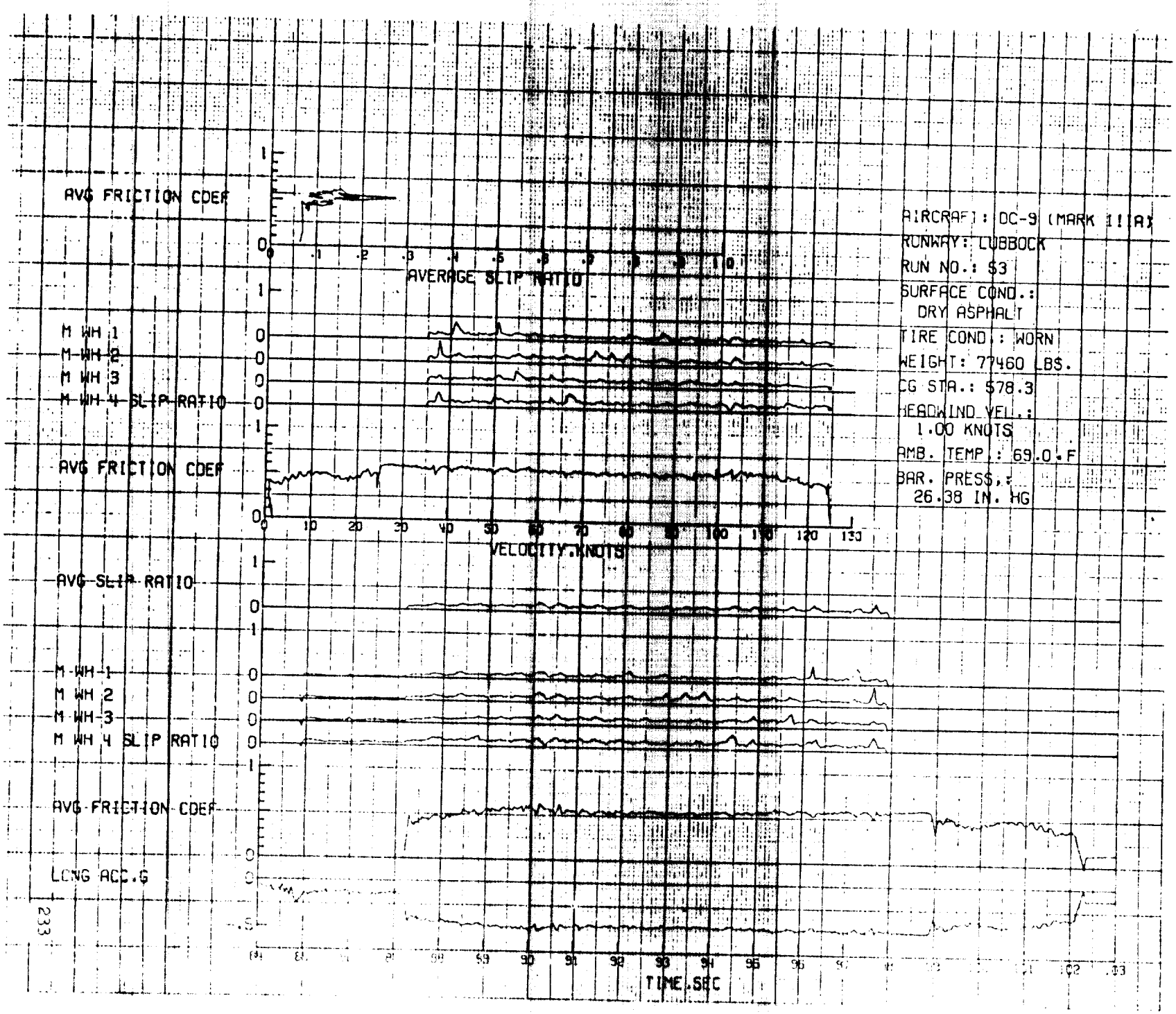

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK II(A)
RUNWAY: LUBBOCK
RUN NO.: S1
SURFACE COND.: DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 79110 LBS.
CG STA.: 577.7
HEADWIND VEL.: 4.60 KNOTS
AMB. TEMP: 73.0 F
BAR. PRESS.: 26.38 IN. HG
REV. THRUST APPLIED DURING RUN

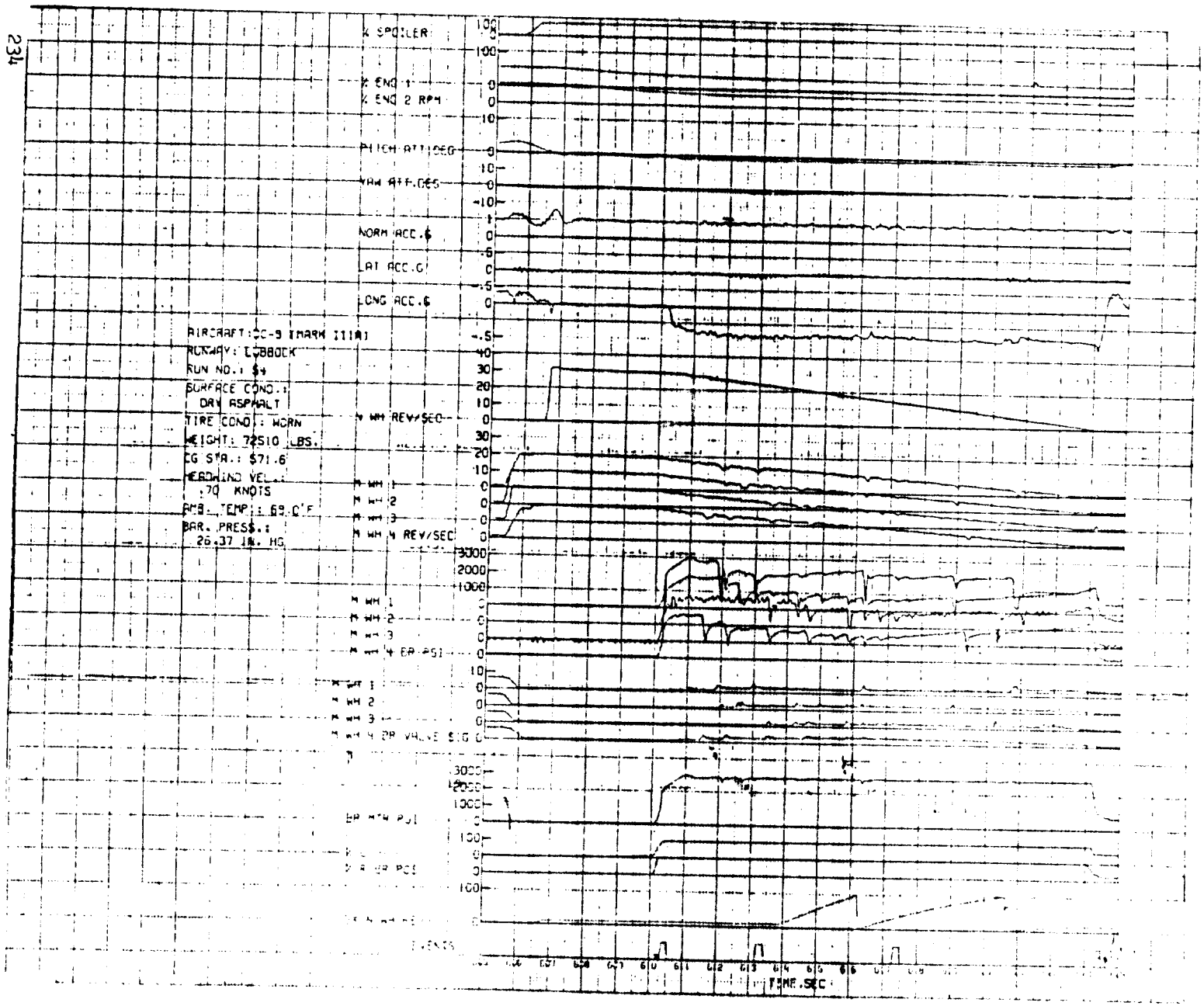
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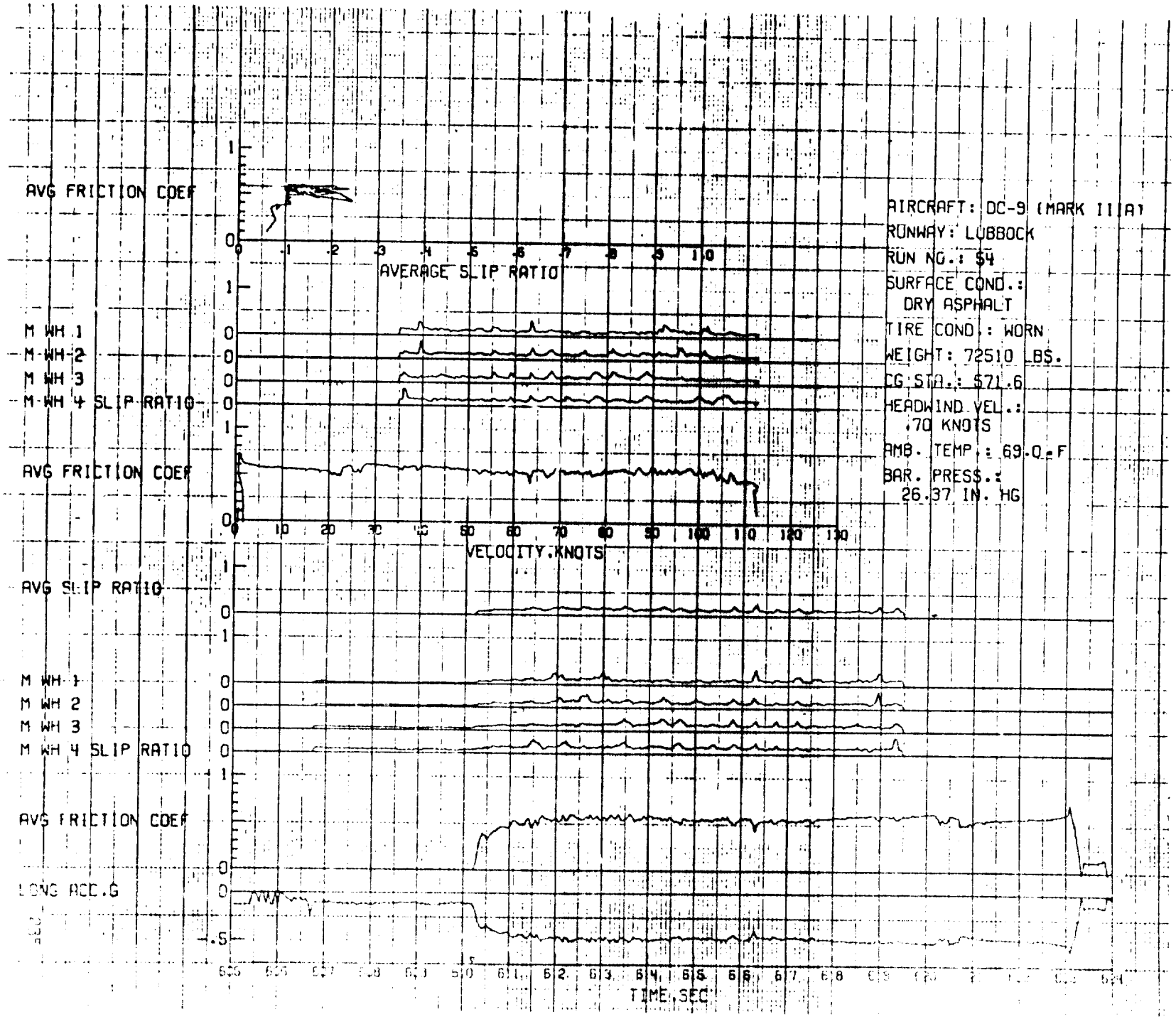


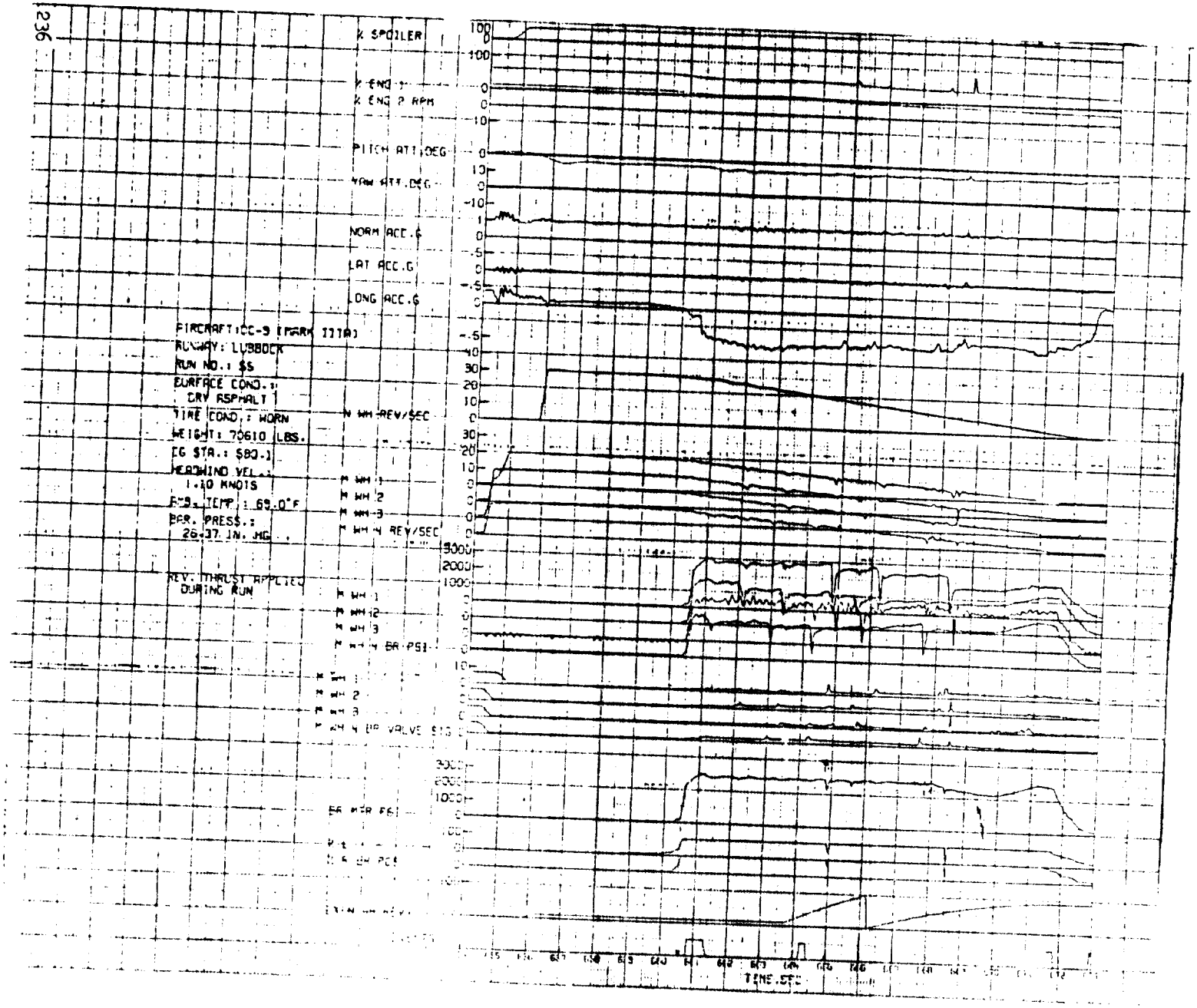

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK III A)
RUNWAY: LUBBOCK
RUN NO.: 52
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 74180 LBS.
CG STA.: 880.7
HEADWIND VEL.:
5.00 KNOTS
AMB. TEMP.: 50.0 F
BAR. PRESS.:
26.46 IN. HG

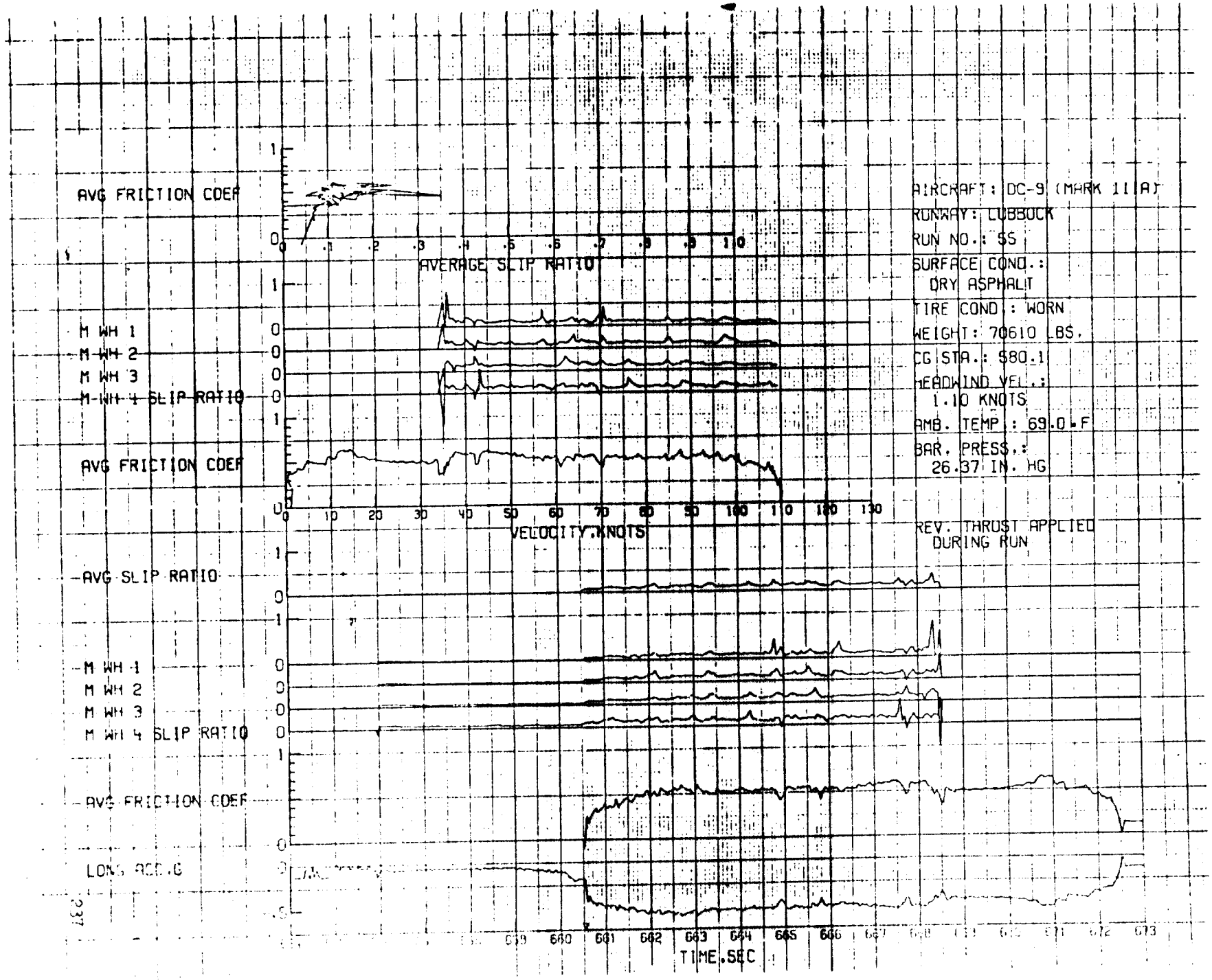

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (MARK III)
RUNWAY: LC86OCK
RUN NO.: 53
SURFACE COND.:
DRY ASPHALT
TIRE COND.: NORM
WEIGHT: 77489 LBS.
CG STA.: 578.3
HEADWIND VEL.:
1.00 KNOTS
AMB. TEMP.: 65.0°F
BAR. PRESS.:
29.38 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE $IG
BR MTR PSI
% L
% R BK PCS
EXIN WH REV
EVENTS
TIME,SEC

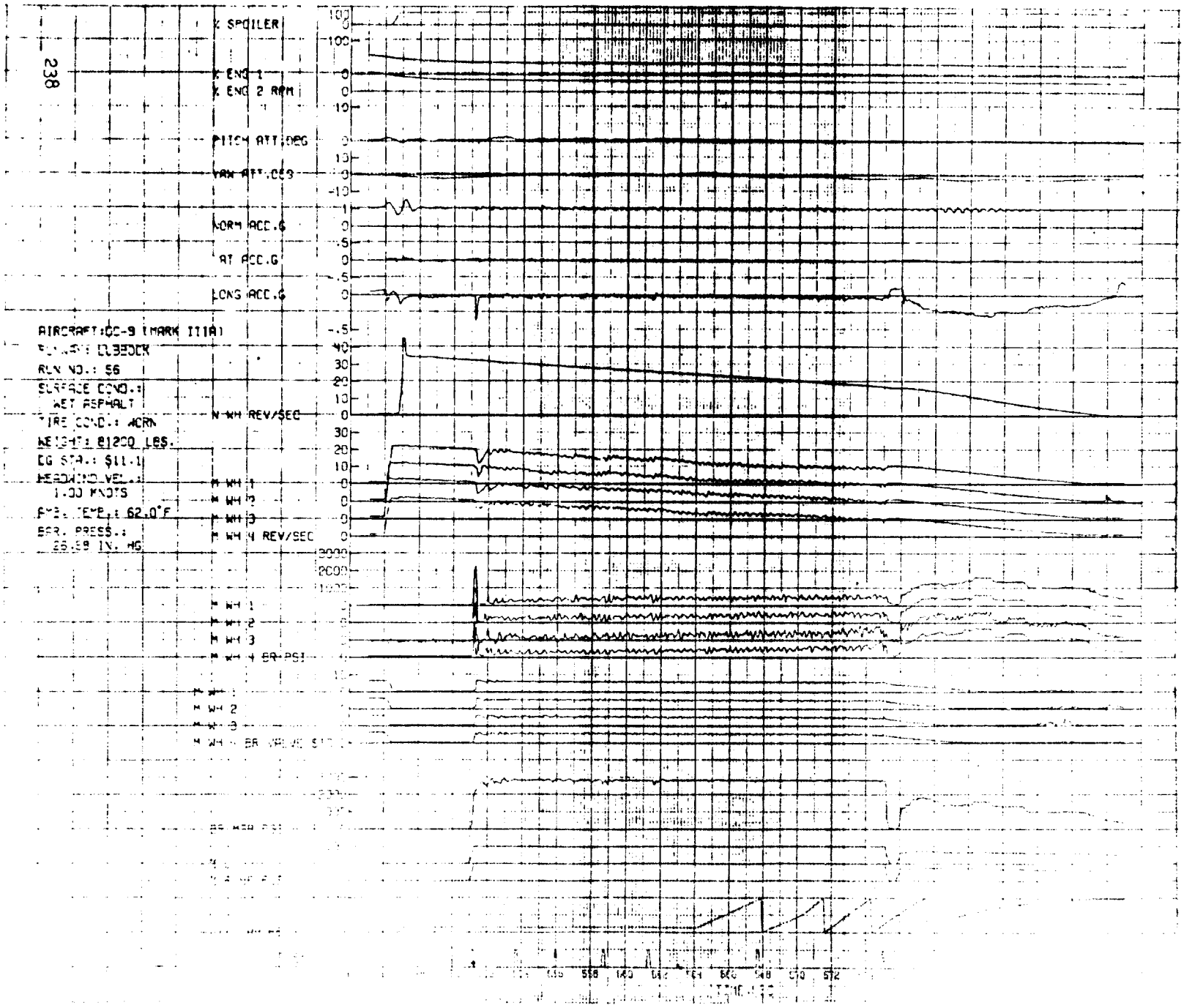

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY, KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME, SEC
AIRCRAFT: DC-9 (MARK II A)
RUNWAY: LUBBOCK
RUN NO.: S3
SURFACE COND.: DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 77460 LBS.
CG STA.: S78.3
HEADWIND VEL.: 1.00 KNOTS
AMB. TEMP.: 69.0 F
BAR. PRESS.: 26.38 IN. HG


% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT: DC-9 (MARK III)
RUNWAY: LUBBOCK
RUN NO.: 54
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 72510 LBS.
CG STA.: 571.6
HEADWIND VEL.:
70 KNOTS
AMB. TEMP.: 69.0°F
BAR. PRESS.:
26.37 IN. HG
% RH REV/SEC
% RH 1
% RH 2
% RH 3
% RH 4 REV/SEC
% RH 1
% RH 2
% RH 3
% RH 4 BR PSI
% RH 1
% RH 2
% RH 3
% RH 4 BR VALVE SIG
BR MTR PSI
TIME,SEC

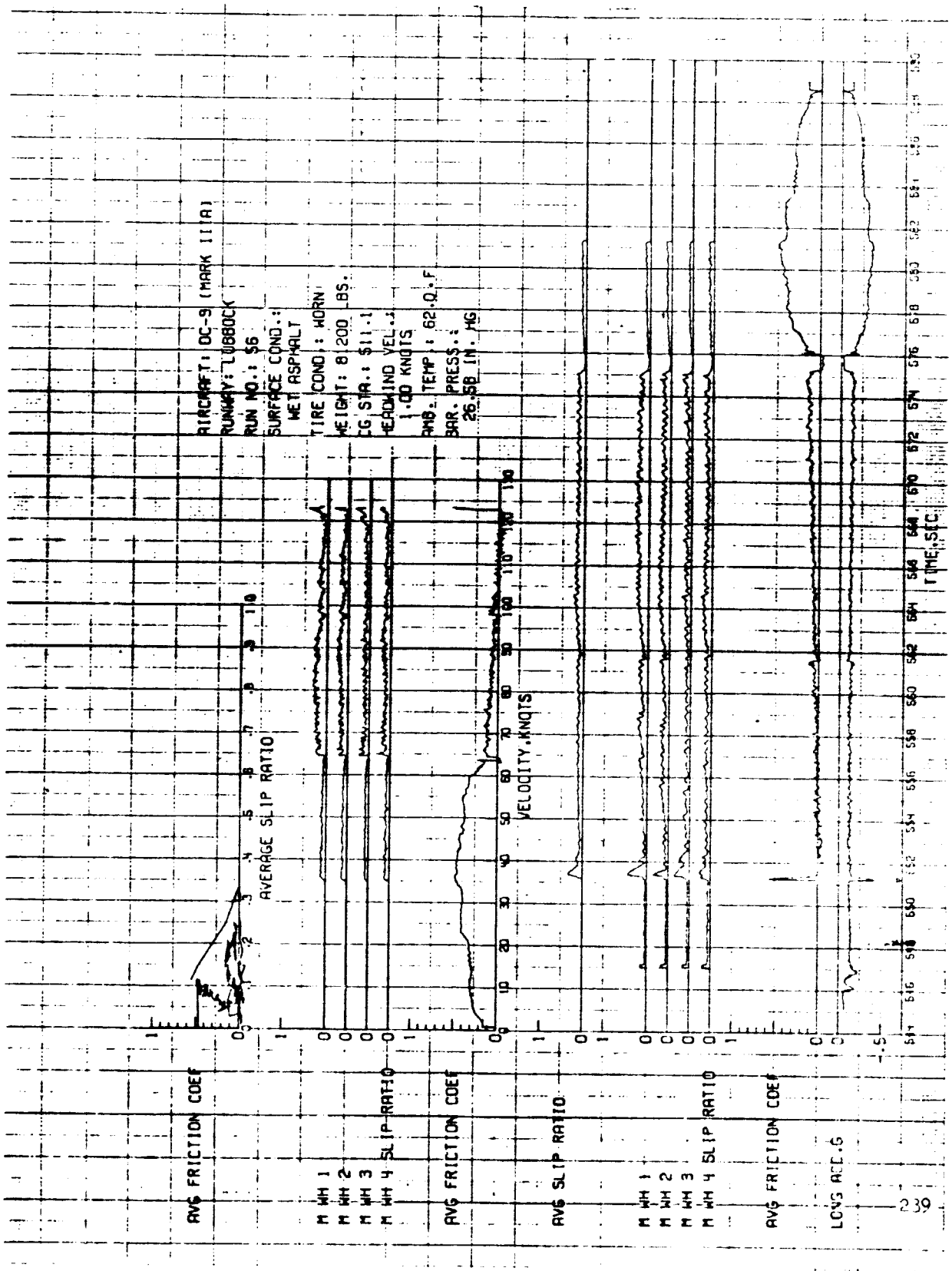

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK II)A)
RUNWAY: LUBBOCK
RUN NO.: $4
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 72510 LBS.
CG STA.: 571.6
HEADWIND VEL.:
.70 KNOTS
AMB. TEMP.: 69.0 F
BAR. PRESS.:
26.37 IN. HG

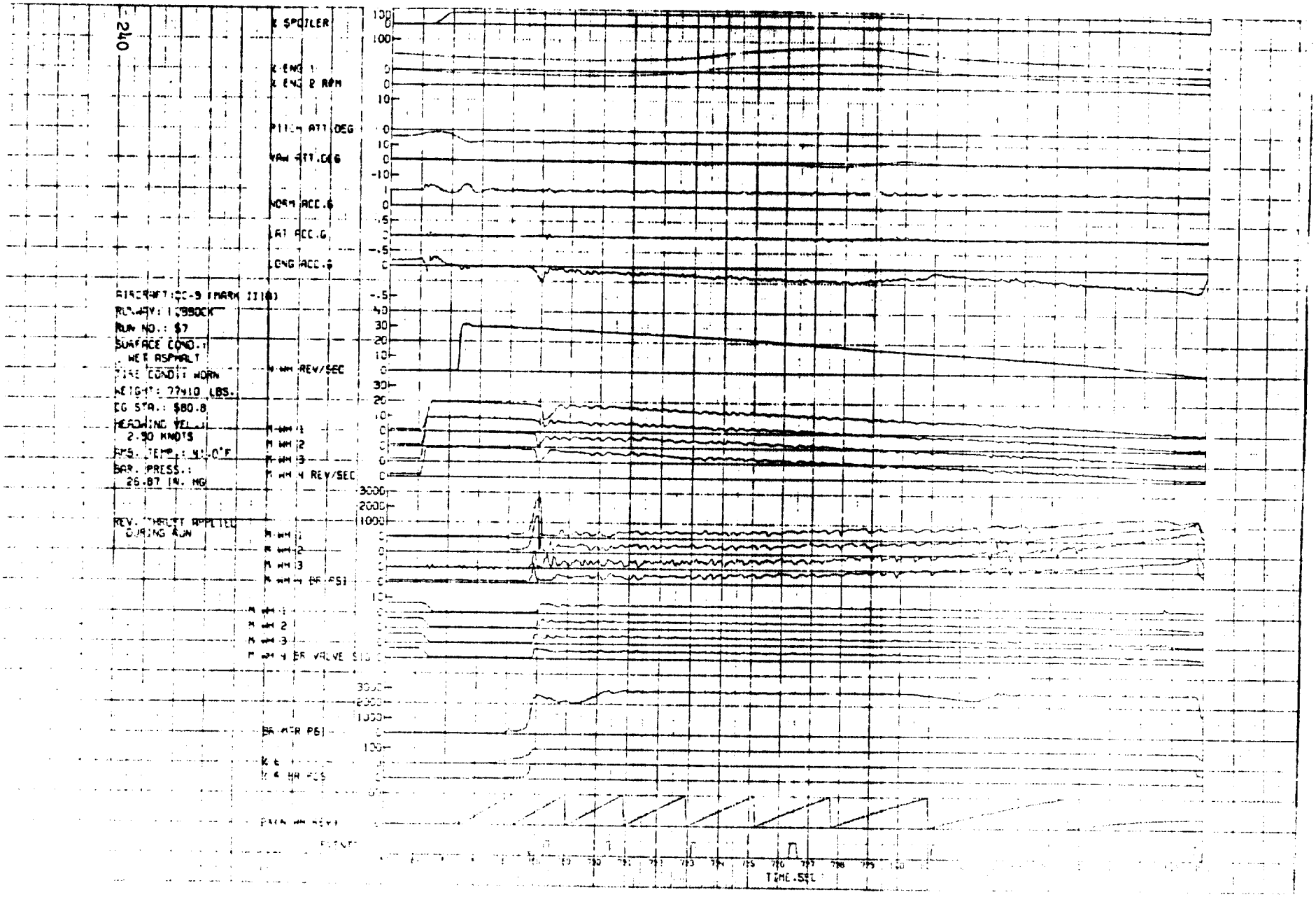

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-9 (SARK III(A))
RUNWAY: LUBBOCK
RUN NO.: 55
SURFACE COND.:
DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 70610 LBS.
[CG STA.: 580.]
HEADWIND VEL.:
1.10 KNOTS
AMB. TEMP.: 69.0°F
BAR. PRESS.:
28.37 IN. HG.
REV. THRUST APPLIED
DURING RUN
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
BR MSR PSI
TIME,SEC

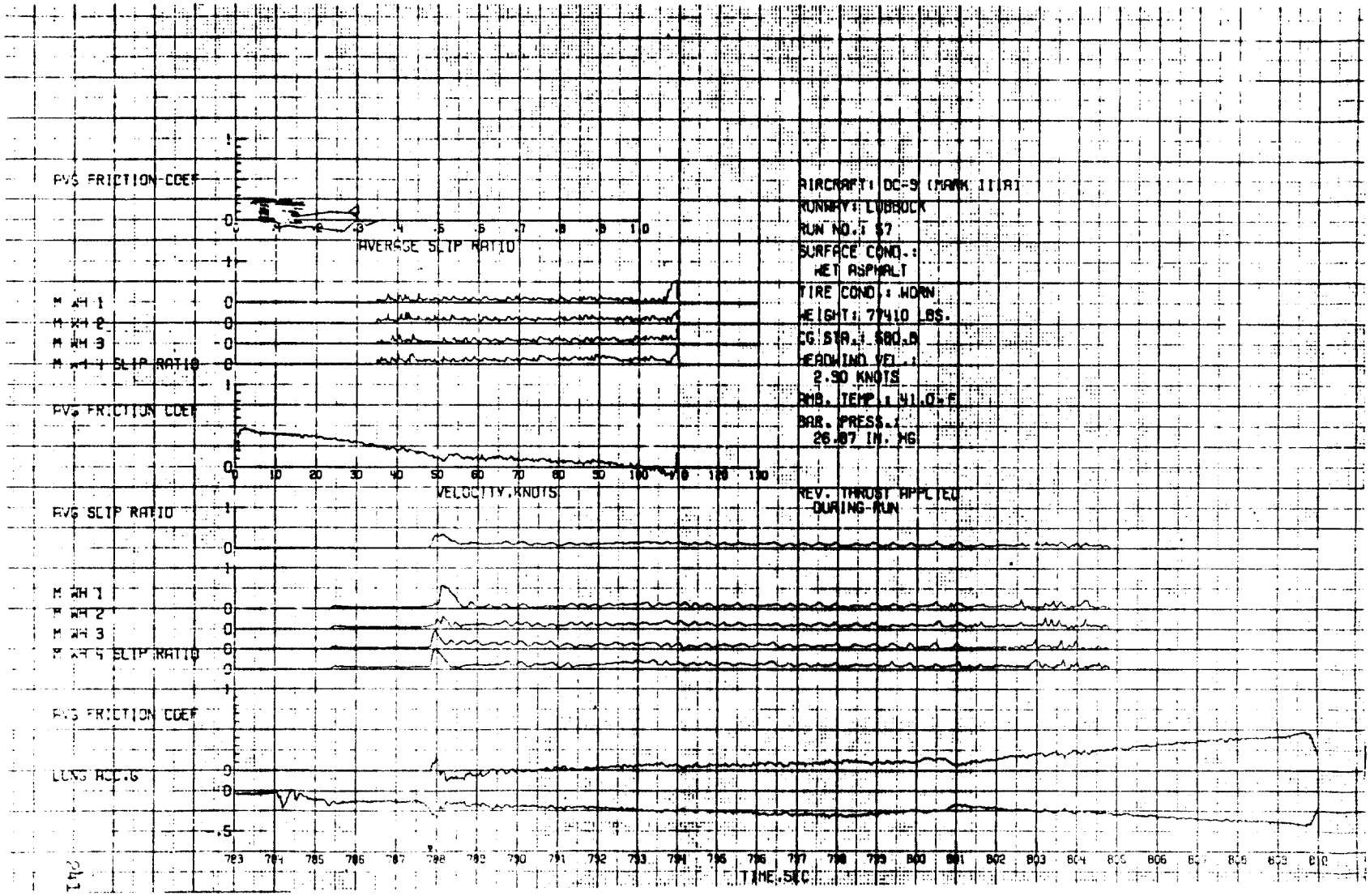

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AIRCRAFT: DC-9 (MARK II)A)
RUNWAY: LUBBOCK
RUN NO.: 55
SURFACE COND.: DRY ASPHALT
TIRE COND.: WORN
WEIGHT: 70610 LBS.
CG STA.: 580.1
HEADWIND VEL.: 1.10 KNOTS
AMB. TEMP.: 69.0 F
BAR. PRESS.: 26.37 IN. HG
REV. THRUST APPLIED DURING RUN
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC

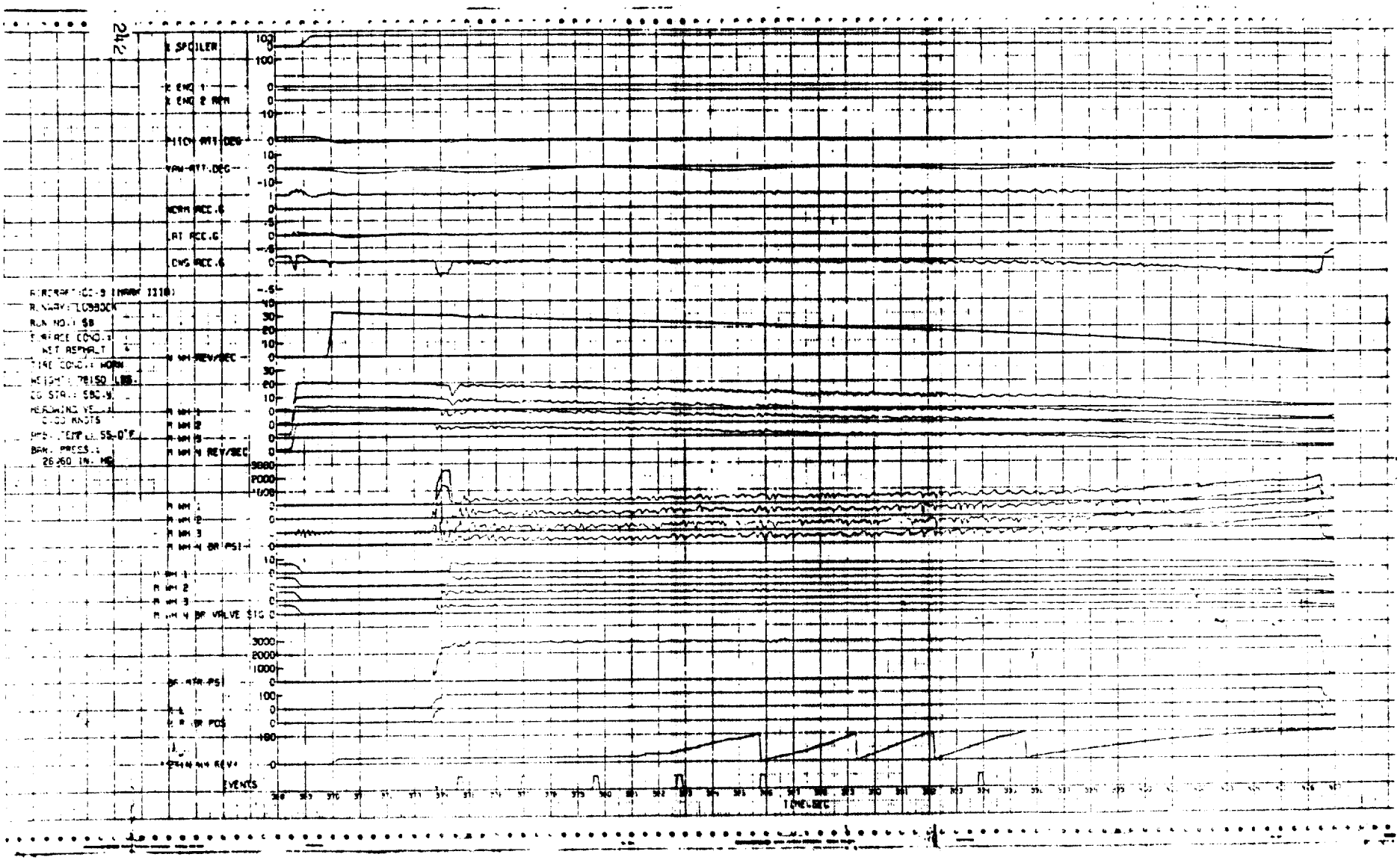

% SPOILER
% ENG 1 RPM
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
AT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (MARK III&)
RUN NO.: 56
SURFACE COND.:
WET ASPHALT
TIRE COND.: ACRN
WEIGHT: 81200 LBS.
CG STA.: 811.1
HEADWIND VEL.:
1.00 KNOTS
AMB. TEMP.: 62.0°F
BAR. PRESS.:
29.69 IN. HG
M WH REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 BR-PSI
M WH 1
M WH 2
M WH 3
M WH 4 BR VALVE SIG
BR MSR PSI

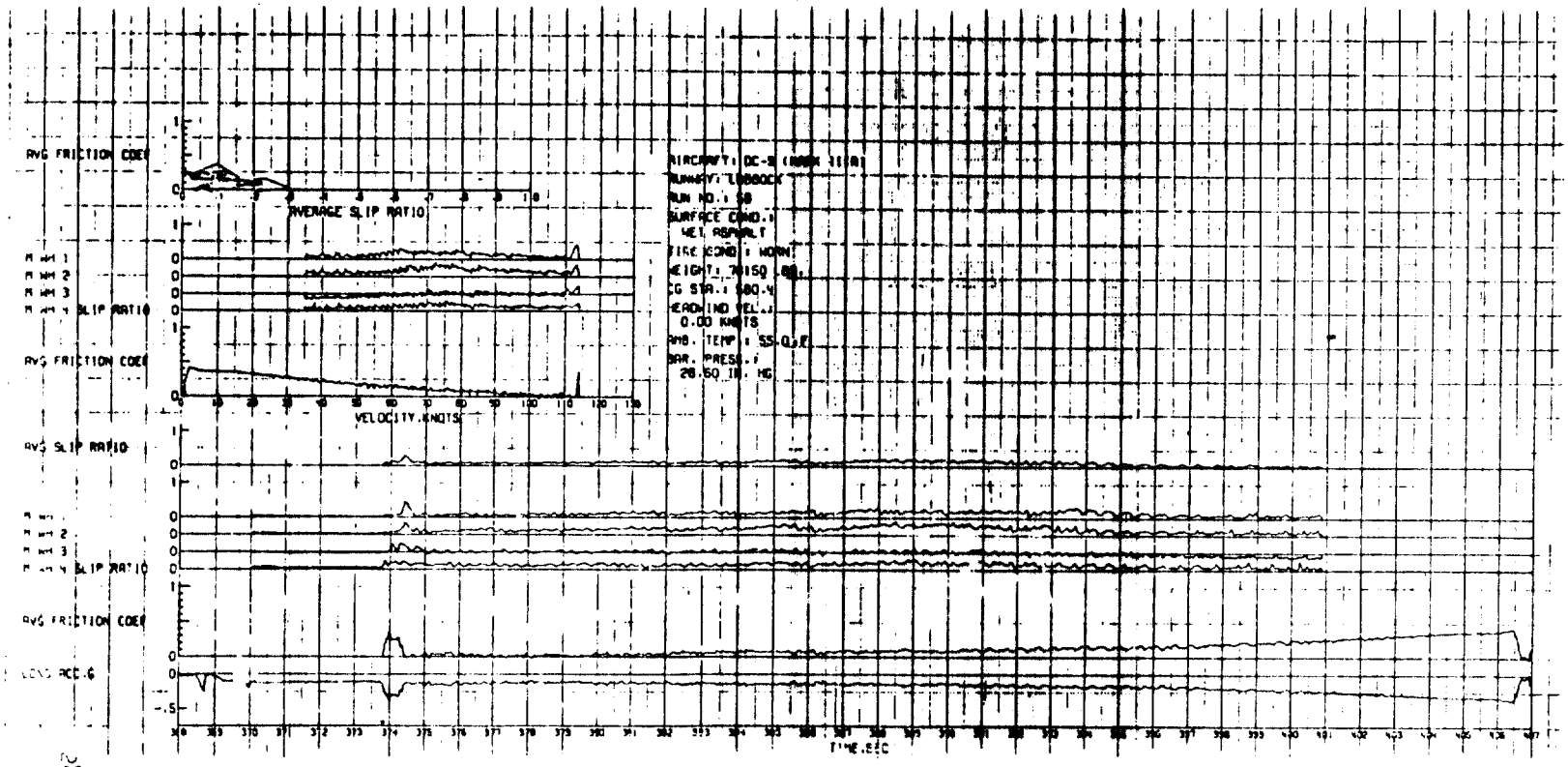
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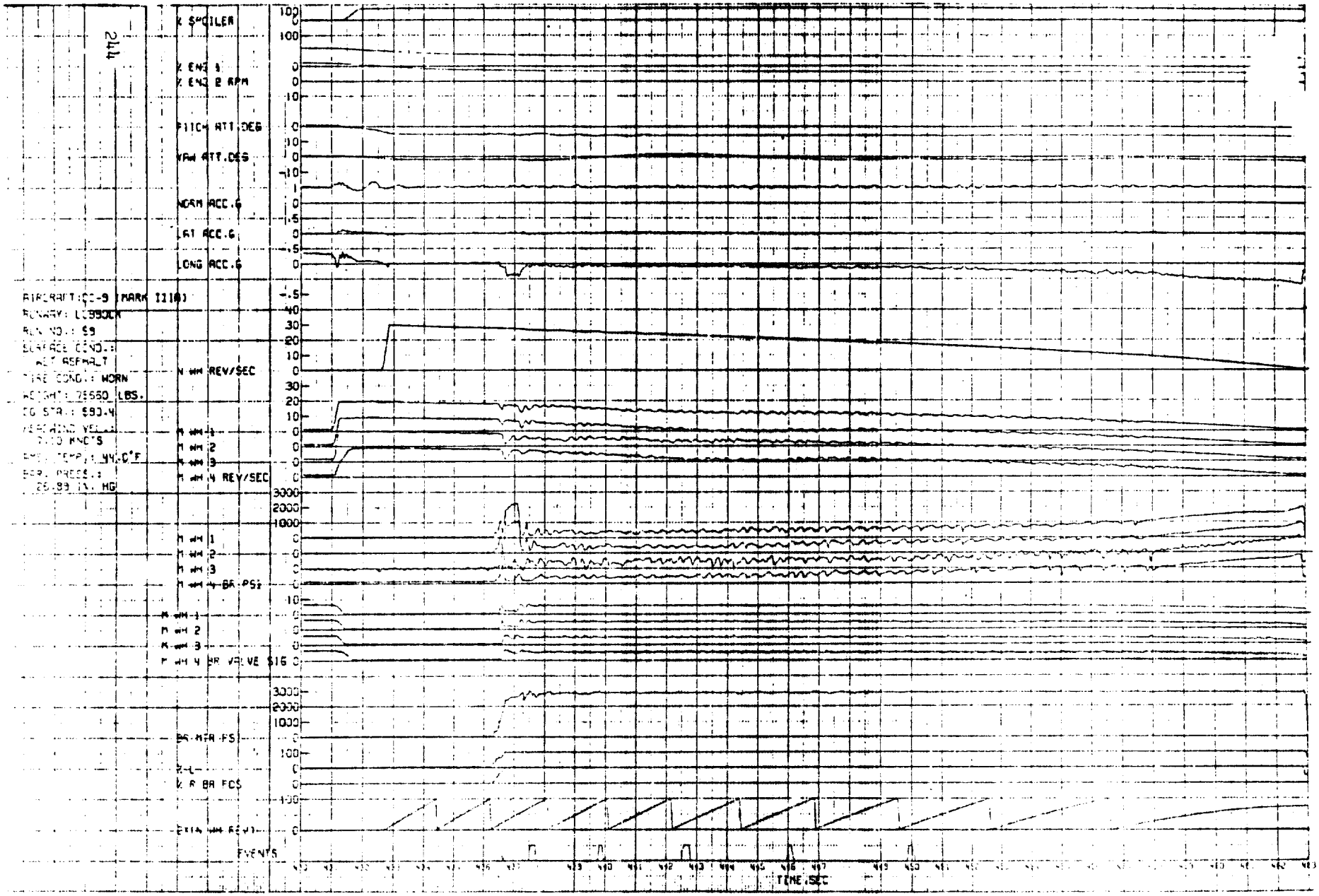


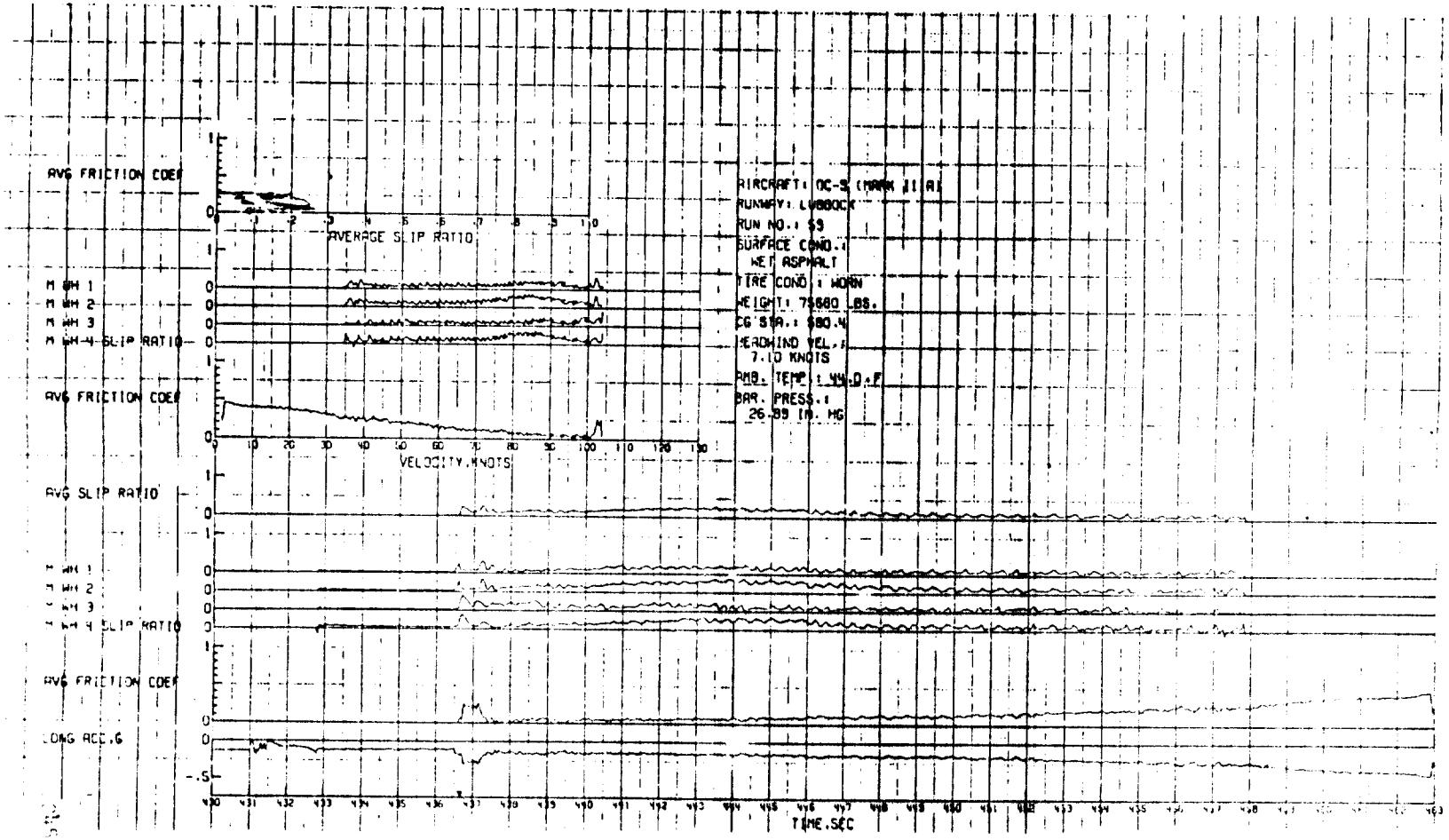

240
K SPOILER
K ENG 1
K ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-9 (MARK III(B))
RUNWAY: 13/31 CK
RUN NO.: 57
SURFACE COND.:
WET ASPHALT
TIRE CONDIT: WORN
WEIGHT: 77910 LBS.
CG STA.: 880.8
HEADING VEL.:
2.90 KNOTS
AMB. TEMP.: 41.0°F
BAR. PRESS.:
26.87 IN. HG
REV. THRUST APPLIED
DURING RUN
M HR REV/SEC
M HR 1
M HR 2
M HR 3
M HR 4 REV/SEC
M HR 1
M HR 2
M HR 3
M HR 4 BR PSI
M HR 1
M HR 2
M HR 3
M HR 4 BR VALVE SIG
BR PRESS PSI
K E
K 4 HR POS
TIME.SEC

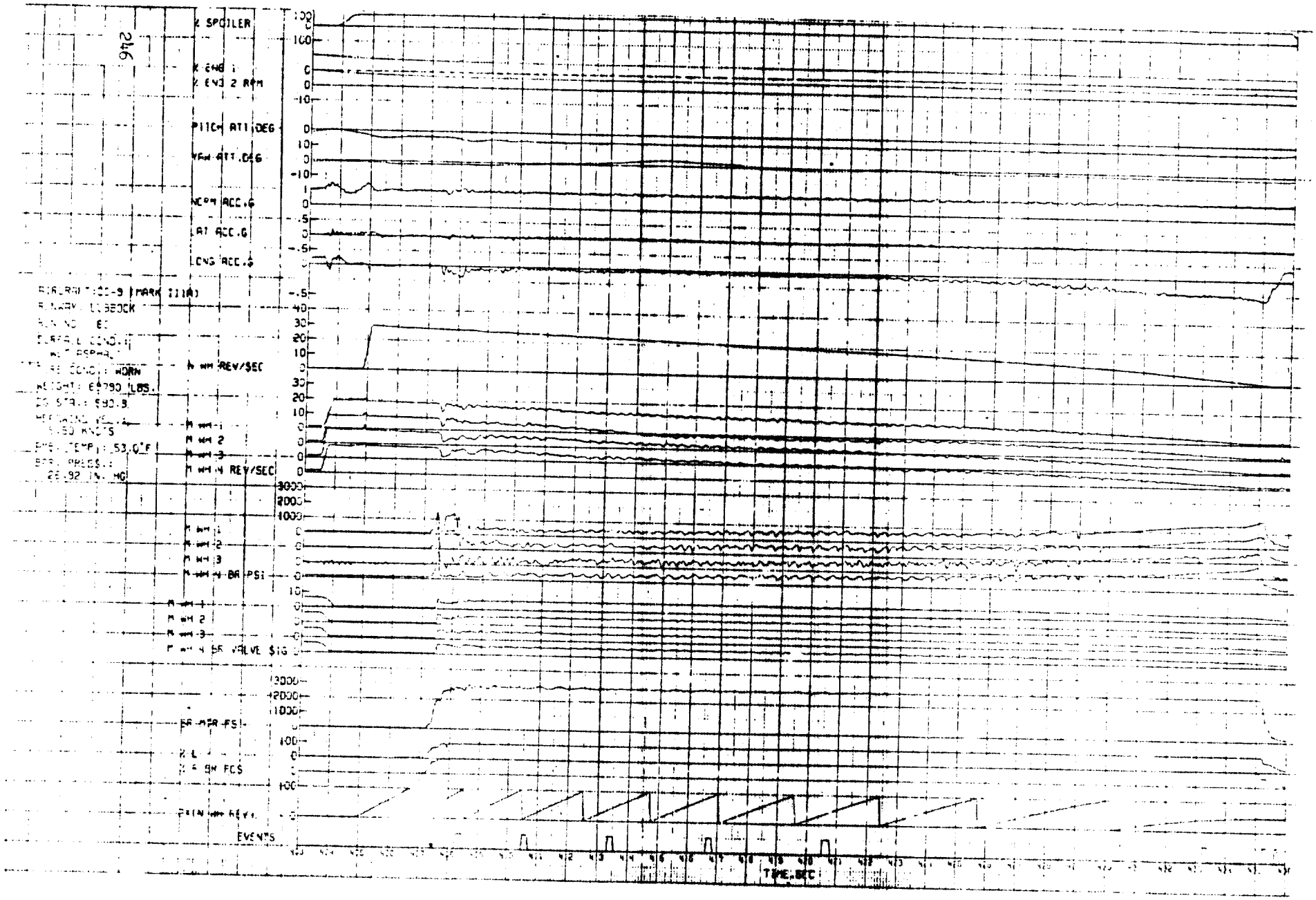

AVG FRICTION-COEF
AVERAGE SLIP RATIO
WH 1
WH 2
WH 3
WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
WH 1
WH 2
WH 3
WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK III)
RUNWAY: LUBBOCK
RUN NO.: 57
SURFACE COND.: WET ASPHALT
TIRE COND.: WORN
WEIGHT: 77410 LBS.
CG STA.: 880.0
HEADWIND VEL.: 2.90 KNOTS
AMB. TEMP.: 41.0 F
BAR. PRESS.: 26.87 IN. HG
REV. THRUST APPLIED DURING RUN

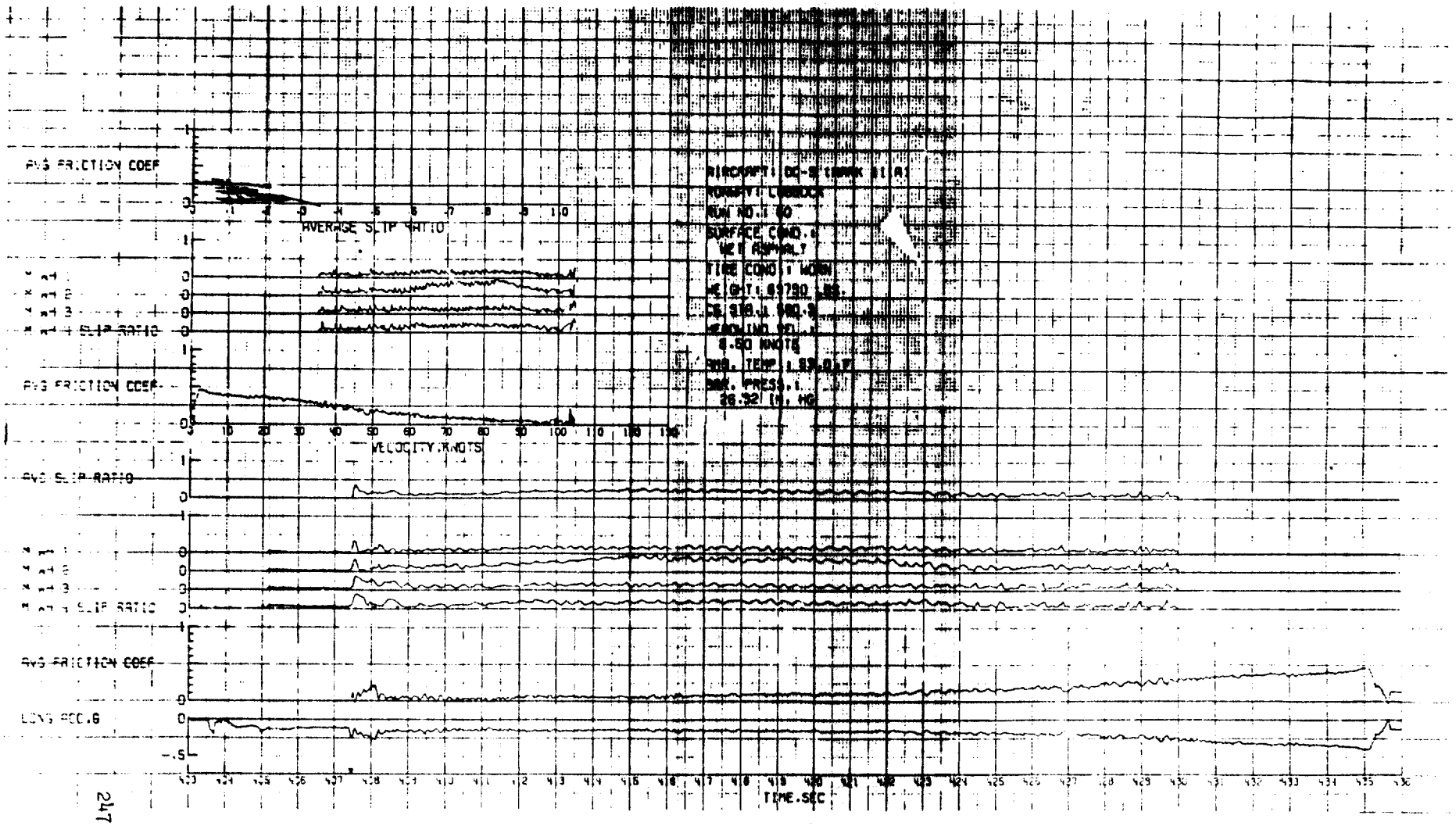

242
L SPOILER
R ENG 1
R ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
R WH REV/SEC
R WH 1
R WH 2
R WH 3
R WH 4 REV/SEC
R WH 1
R WH 2
R WH 3
R WH 4 BR PSI
R WH 1
R WH 2
R WH 3
R WH 4 BR VALVE SIG
BK PRESS PSI
L R BR POS
EVENTS
TIME SEC

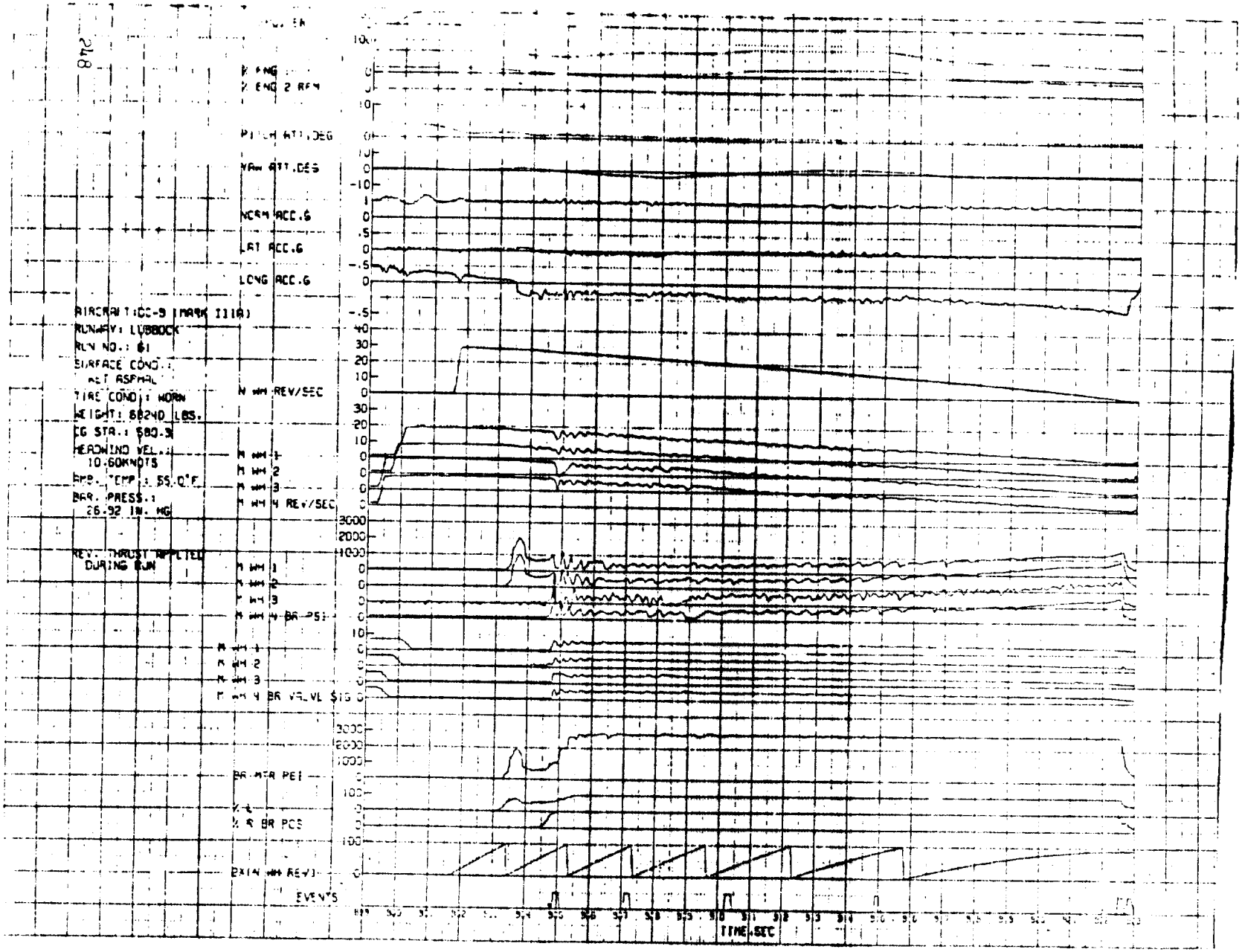

AVG FRICTION COEF
AVERAGE SLIP RATIO
SLIP RATIO
VELOCITY,KNOTS
AVG SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC

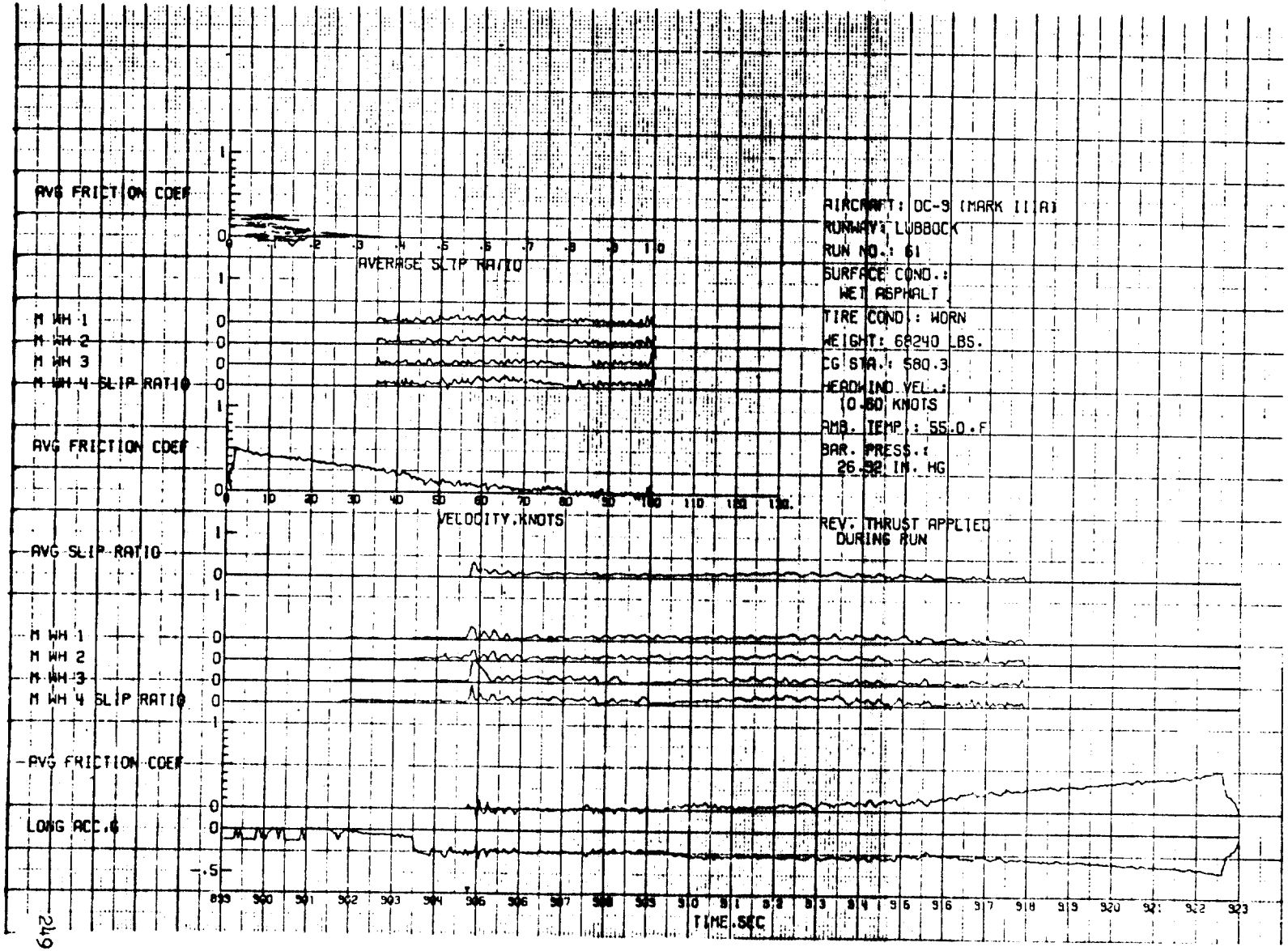

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE SIG
BRAKE PRESS
L-L
L & R BR FCS
EVENTS
TIME,SEC

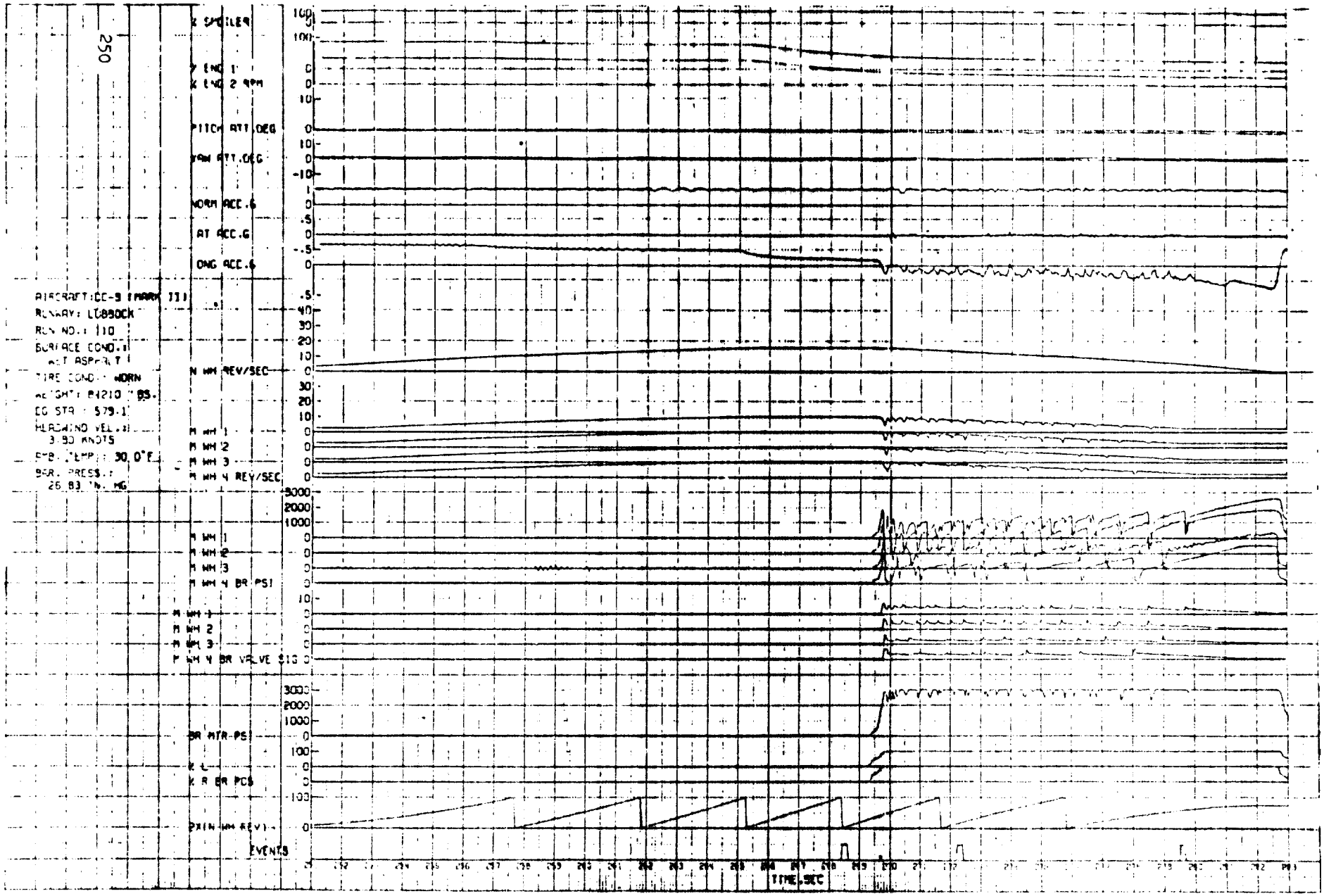

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: OC-9 (MARK II A)
RUNWAY: LUBBOCK
RUN NO.: 59
SURFACE COND.:
WET ASPHALT
TIRE COND.: WORN
WEIGHT: 75680 LBS.
CG STA.: 580.4
HEADWIND VEL.:
7.10 KNOTS
AMB. TEMP.: 44.0 F
BAR. PRESS.:
26.89 IN. HG

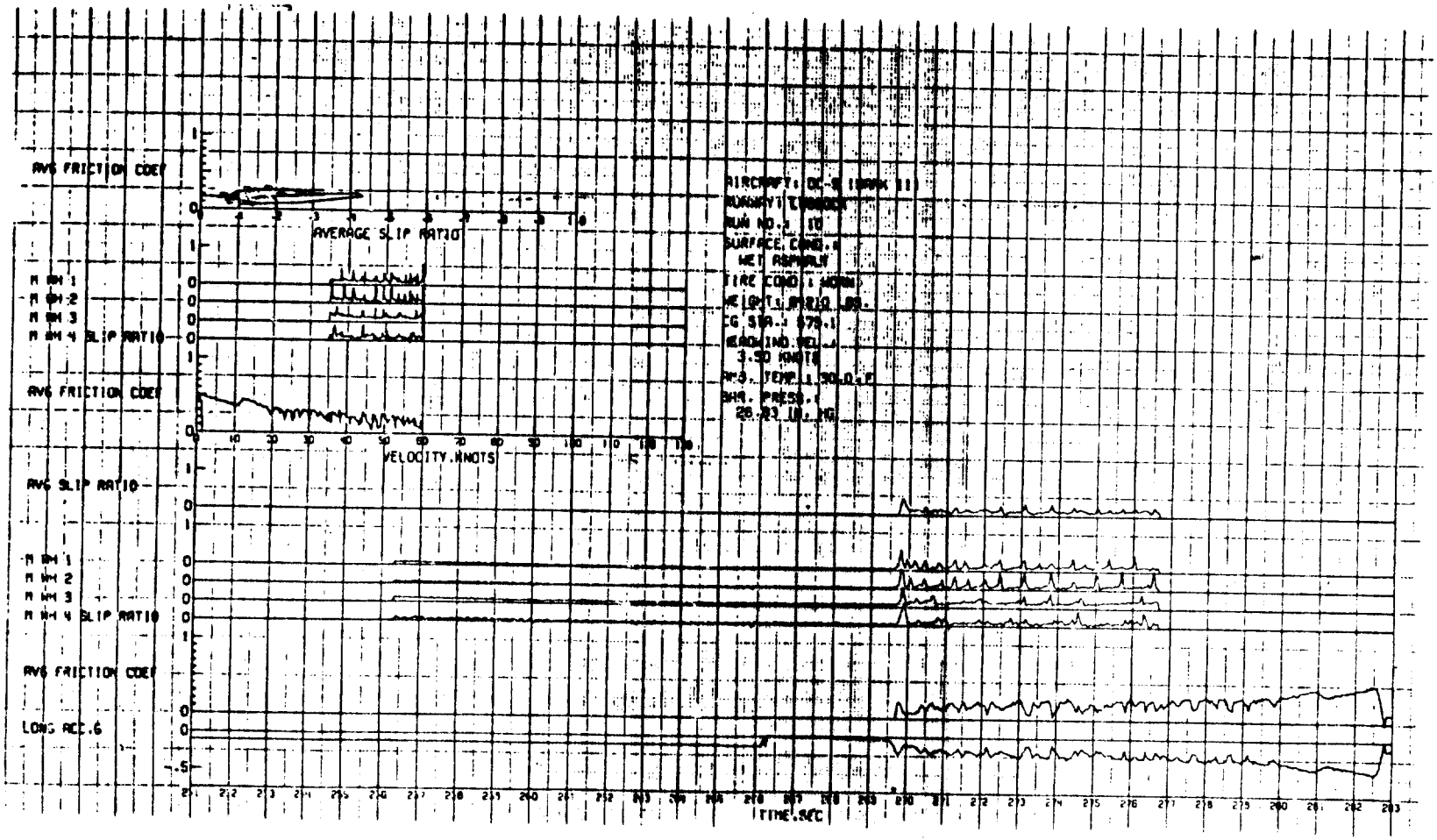

% SPOILER
% END 1
% END 2 RPM
PITCH ATT, DEG
YAW ATT, DEG
NORM ACC, G
AT ACC, G
LONG ACC, G
EVENTS
TIME, SEC


AVG FRICTION COEF
AVERAGE SLIP RATIO
AIRCRAFT: DC-9 SUPER 81 A1
RUN NO.: 60
SURFACE COND.: WET RUNWAY
TIRE COND.: WORN
8.50 KNOTS
AVG SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
VELOCITY,KNOTS
TIME,SEC

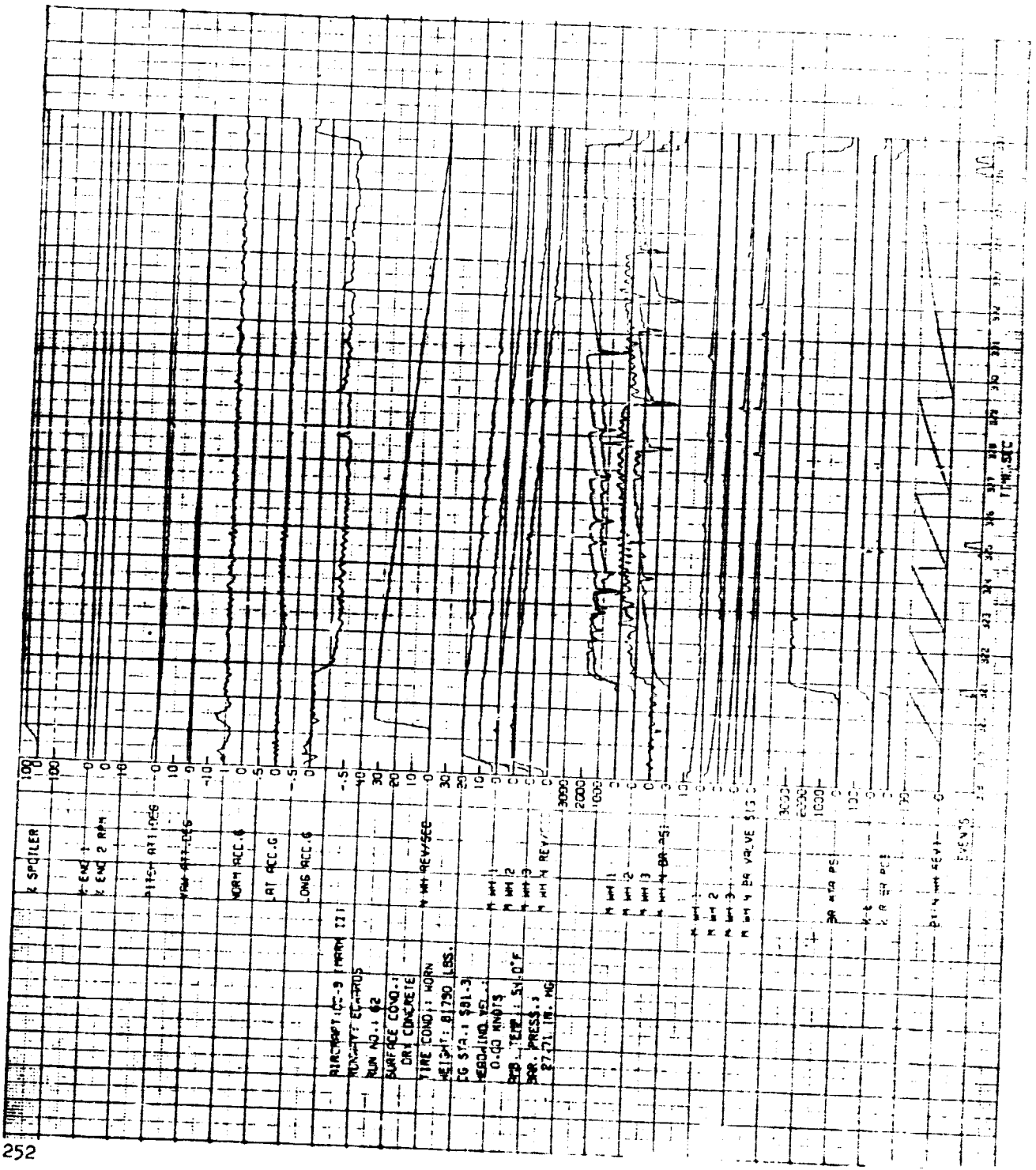

PITCH ATT.,DEG
YAW ATT.,DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-9 (MARK III&)
RUNWAY: LUBBOCK
RUN NO.: 61
SURFACE COND.:
WET ASPHAL
TIRE COND.: WORN
WEIGHT: 88240 LBS.
CG STA.: 580.3
HEADWIND VEL.:
10.60KNOTS
AMB. TEMP.: 55.0°F
BAR. PRESS.:
26.92 IN. HG
REV. THRUST APPLIED
DURING RUN
BR PSI
BR VALVE SIG
BR MTR PSI
EVENTS
TIME,SEC

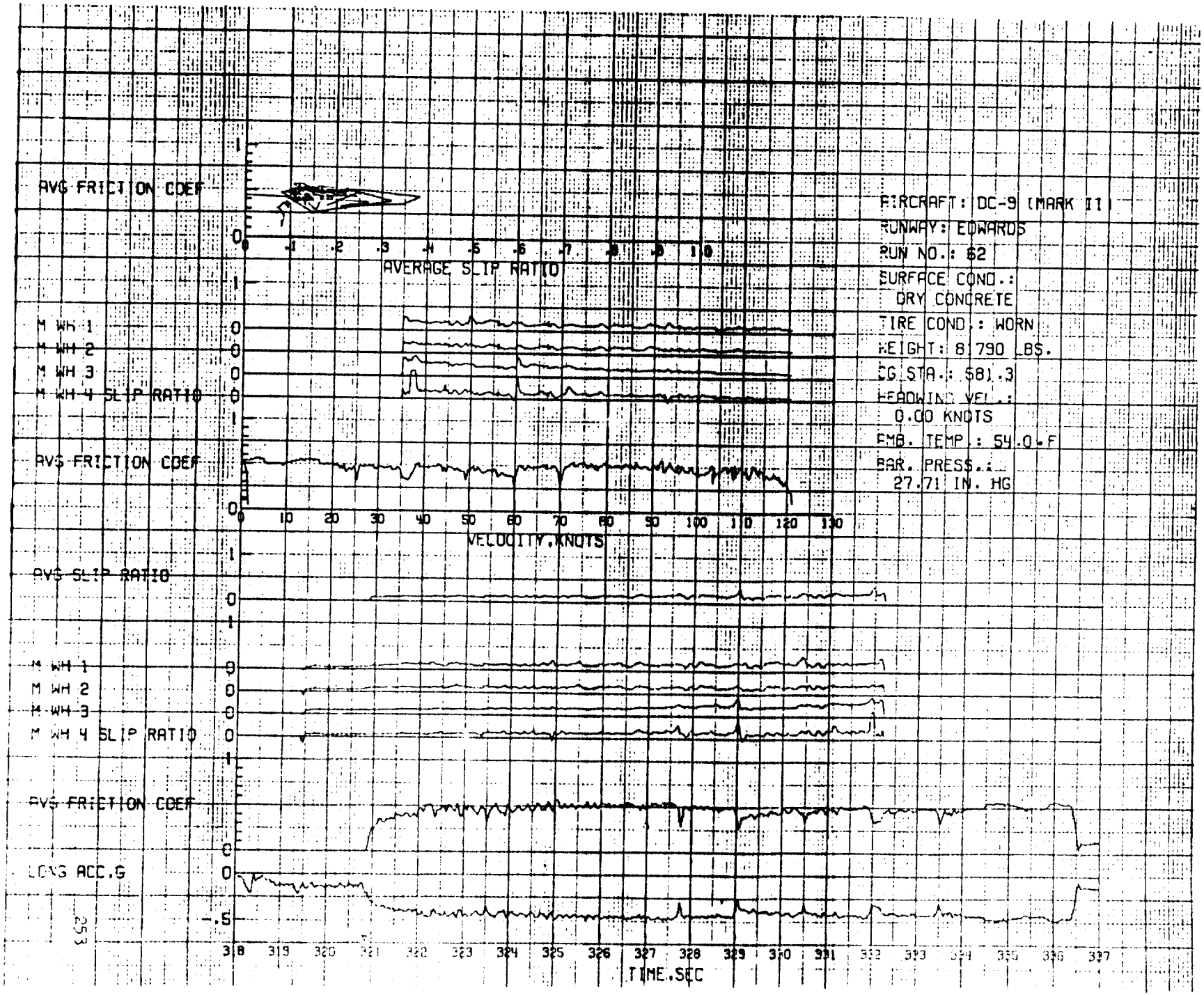

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AIRCRAFT: DC-9 (MARK II A)
RUNWAY: LUBBOCK
RUN NO.: 61
SURFACE COND.: WET ASPHALT
TIRE COND.: WORN
WEIGHT: 68240 LBS.
CG STA.: 580.3
HEADWIND VEL.: 10.80 KNOTS
AMB. TEMP.: 55.0 F
BAR. PRESS.: 26.92 IN. HG
REV. THRUST APPLIED DURING RUN
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC

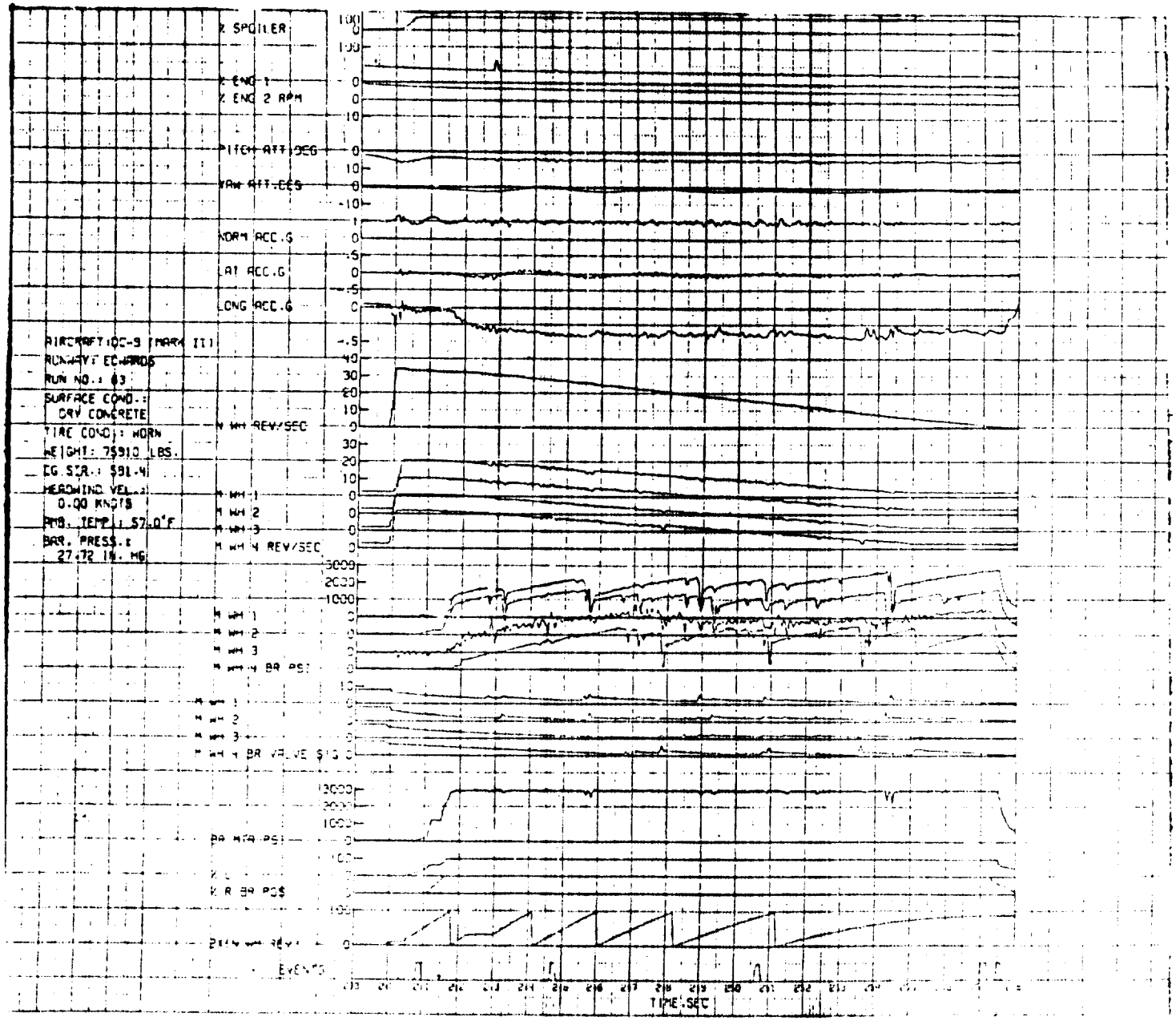

250
% SPOILER
PITCH ATT.DEG
NORM ACC.G
AT ACC.G
ONG ACC.G
AIRCRAFT:CC-9 (MARK III)
RUNWAY: LUBBOCK
RUN NO.: 110
SURFACE COND.:
WET ASPHALT
TIRE COND.: WORN
WEIGHT: 84210 LBS.
CG STA.: 579.1
HEADWIND VEL.:
3.90 KNOTS
AMB. TEMP.: 30.0°F
BAR. PRESS.:
28.83 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE SIG
BR MTR-PSI
% L
% R BR PCS
PXIN WH REV
EVENTS
TIME,SEC

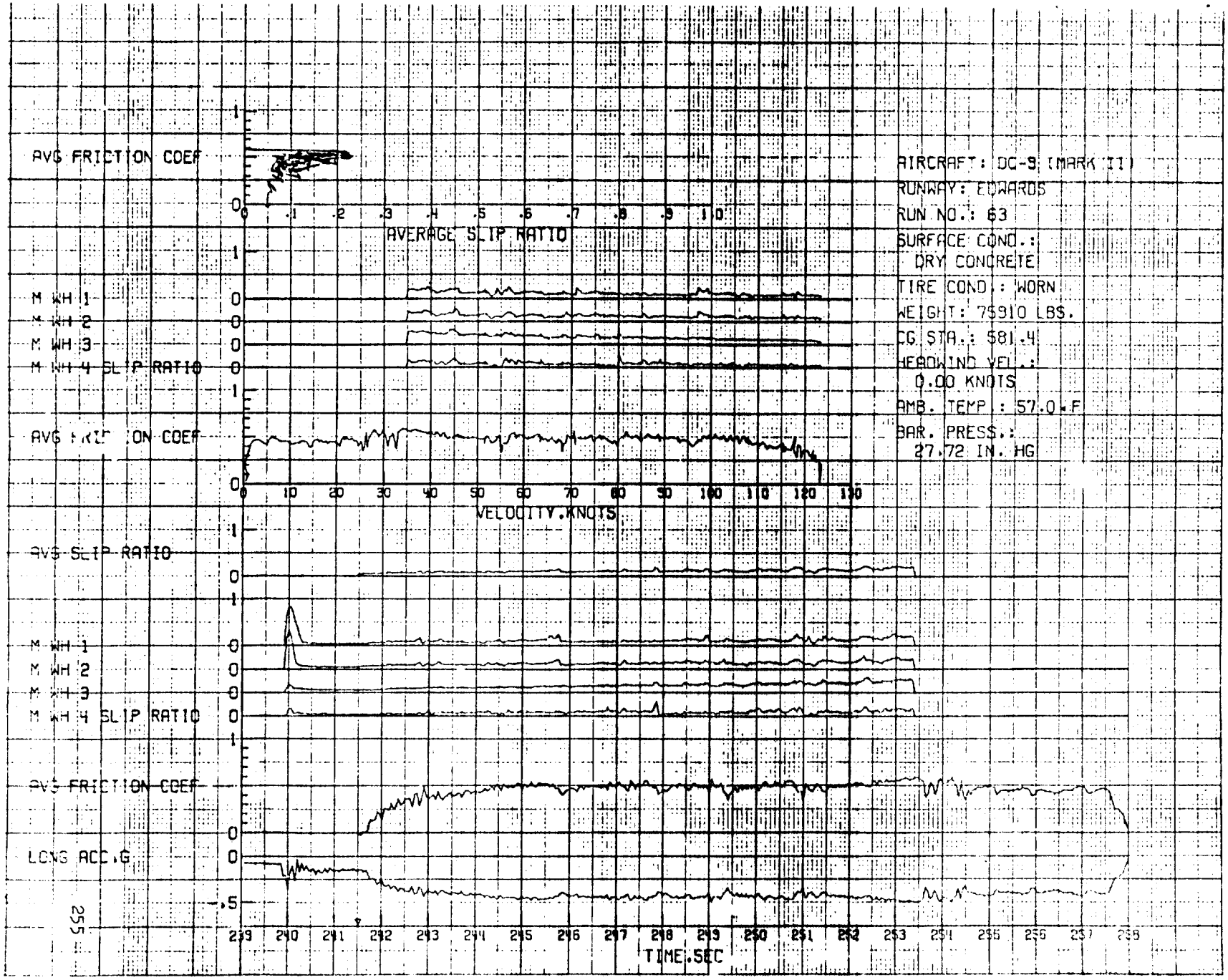

AVG FRICTION COEF
AVERAGE SLIP RATIO
VELOCITY.KNOTS
AVG SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC

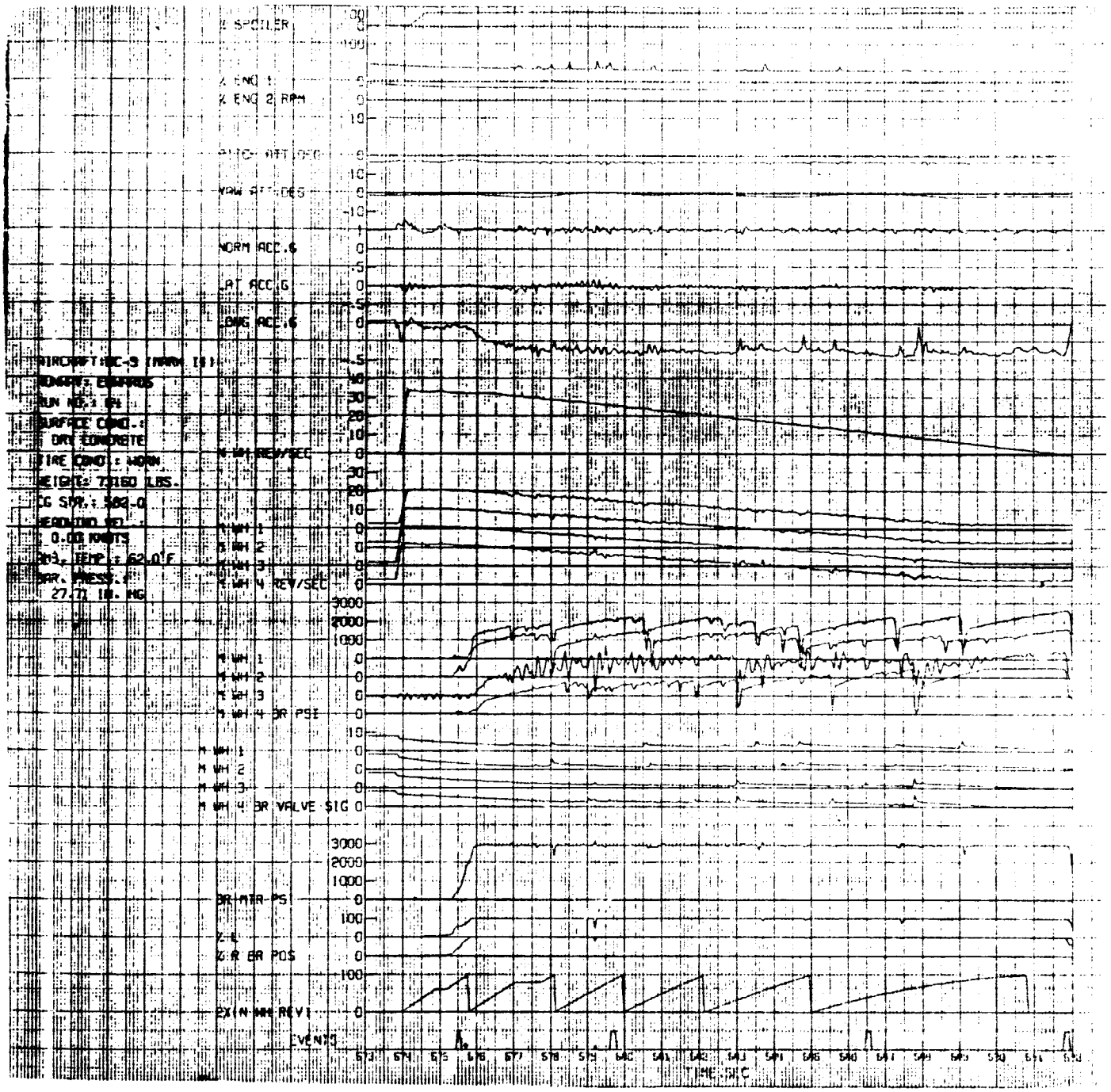
REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

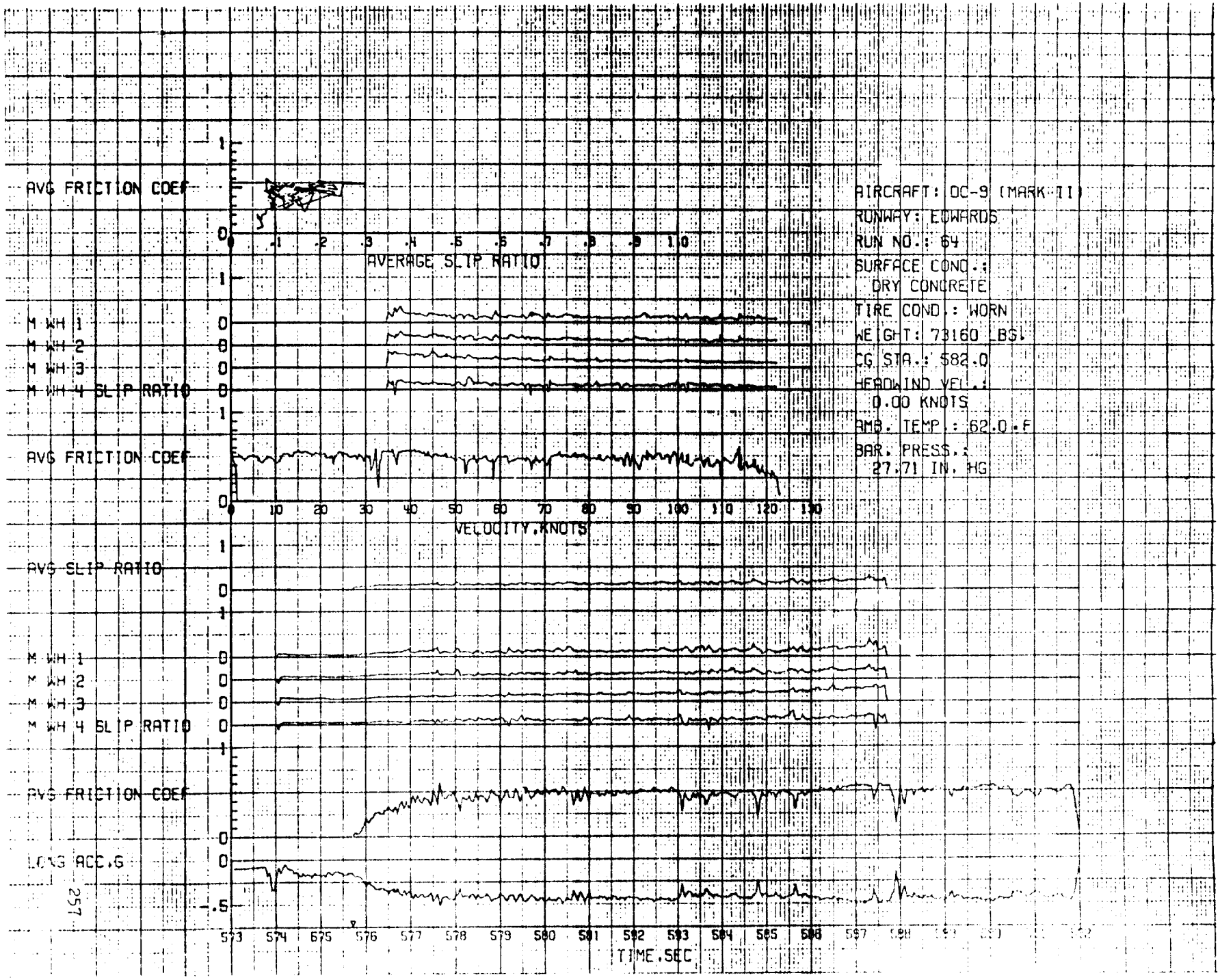


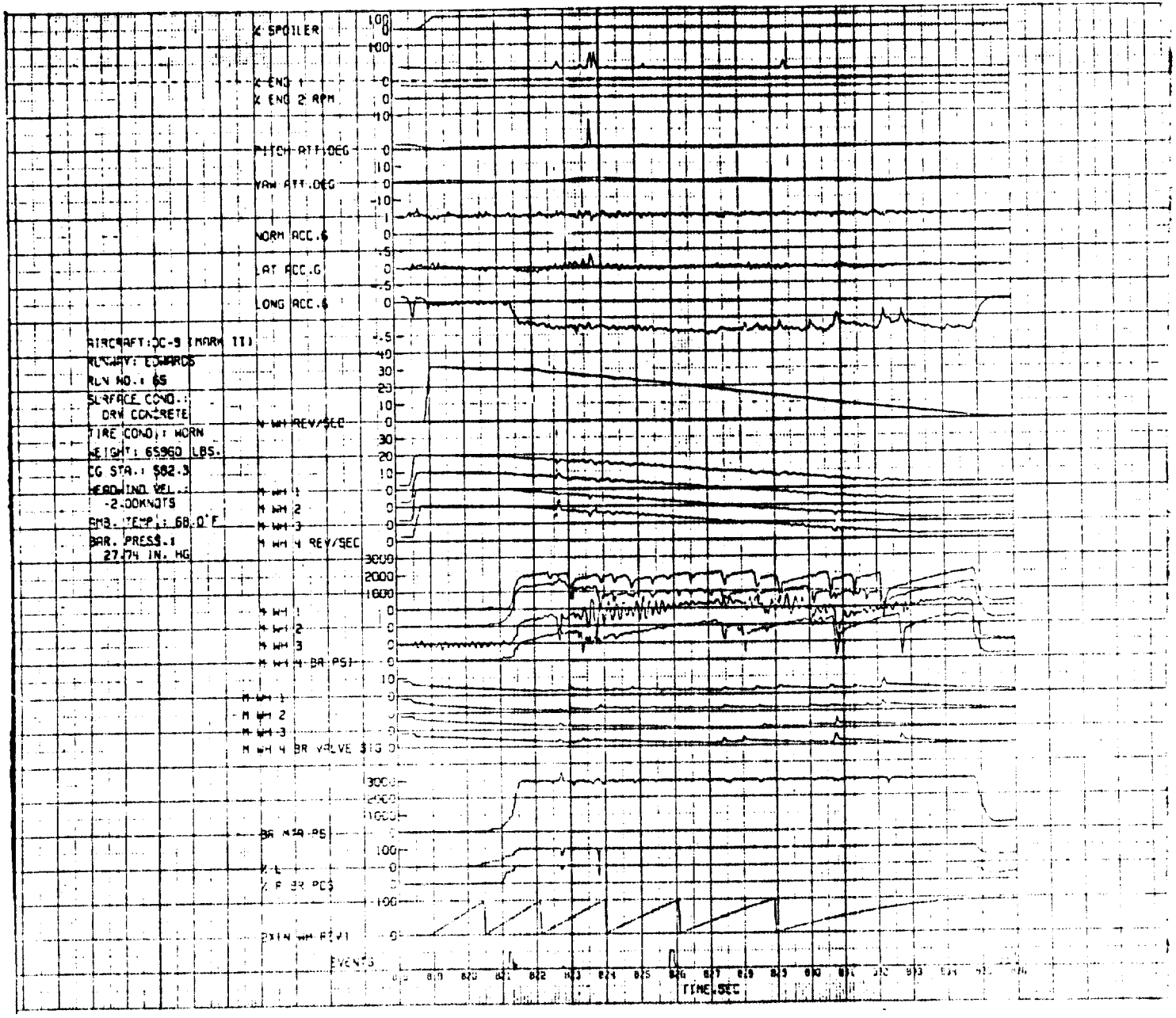

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC,G
TIME,SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: EDWARDS
RUN NO.: 62
SURFACE COND.: DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 81790 LBS.
CG STA.: 581.3
HEADWIND VEL.: 0.00 KNOTS
AMB. TEMP.: 54.0 F
BAR. PRESS.: 27.71 IN. HG

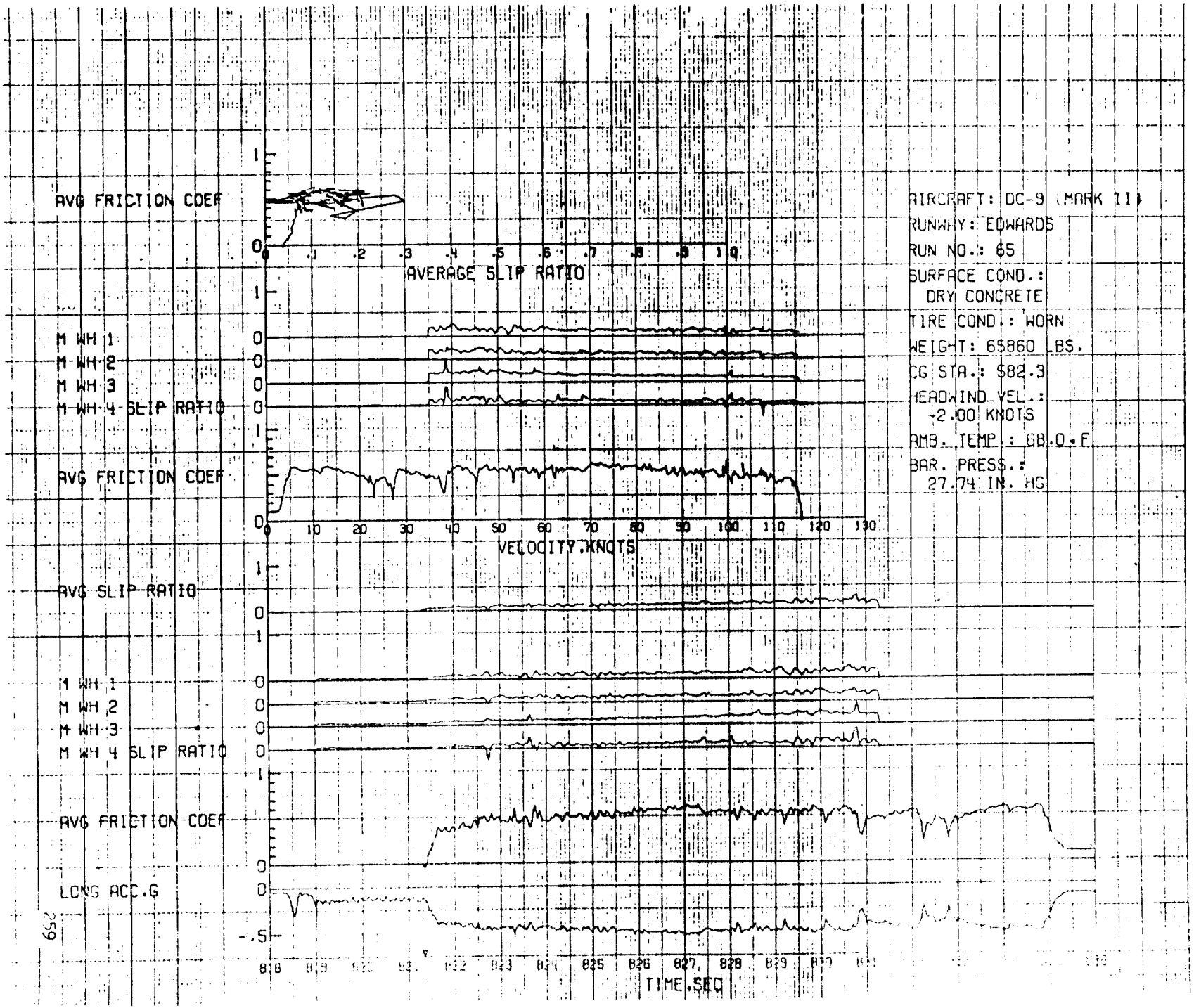

% SPOILER
% ENC 1
% ENC 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:OC-9 (MARK III)
RUNWAY: EDWARDS
RUN NO.: 03
SURFACE COND.:
DRY CONCRETE
TIRE COND.: NORM
WEIGHT: 75910 LBS.
CG STA.: 591.4
HEADWIND VEL.:
0.00 KNOTS
AMB. TEMP.: 57.0°F
BAR. PRESS.:
27.72 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE SIG
BR MTR PSI
K L
K R BR POS
EVENTS
TIME,SEC


AVG FRICTION COEF
AVERAGE SLIP RATIO
AIRCRAFT: DC-9 (MARK II)
RUNWAY: EDWARDS
RUN NO.: 63
SURFACE COND.: DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 75910 LBS.
CG STA.: 581.4
HEADWIND VEL.: 0.00 KNOTS
AMB. TEMP.: 57.0 F
BAR. PRESS.: 27.72 IN. HG
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC

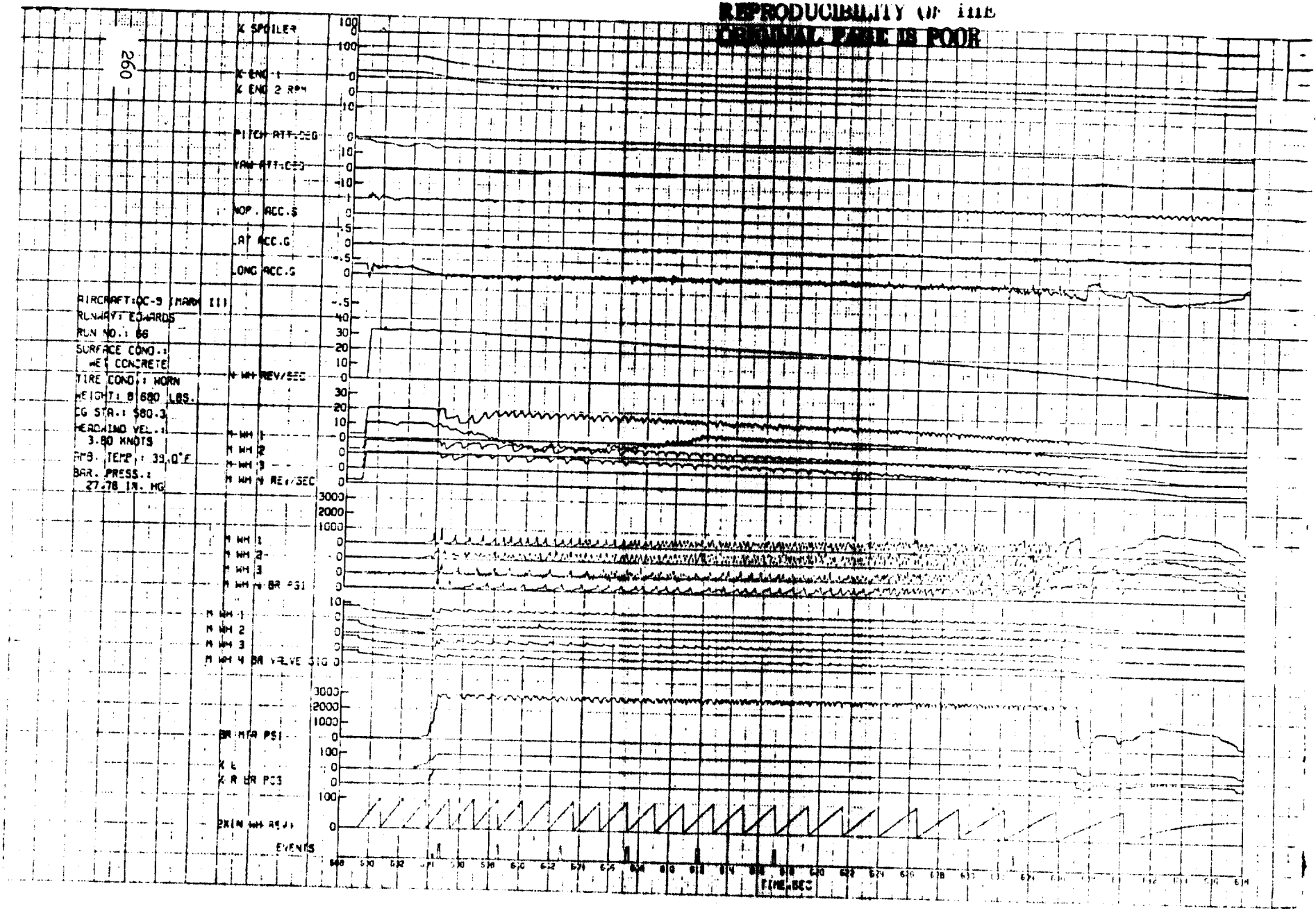

% SPOILER
% ENG 1
% ENG 2 RPM
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (MARK II)
POWER: EXTRNS
RUN NO.: 84
SURFACE COND.:
DRY CONCRETE
TIRE COND.: NORM
WEIGHT: 73160 LBS.
CG STA.: 582.0
HEADWIND VEL.:
0.00 KNOTS
AIR TEMP.: 62.0°F
BAR. PRESS.:
27.77 IN. HG
M WH 1 REV/SEC
M WH 2
M WH 3
M WH 4 REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 BR PSI
M WH 1
M WH 2
M WH 3
M WH 4 BR VALVE SIG
BR MTR PSI
% BR POS
EVENTS
TIME SEC

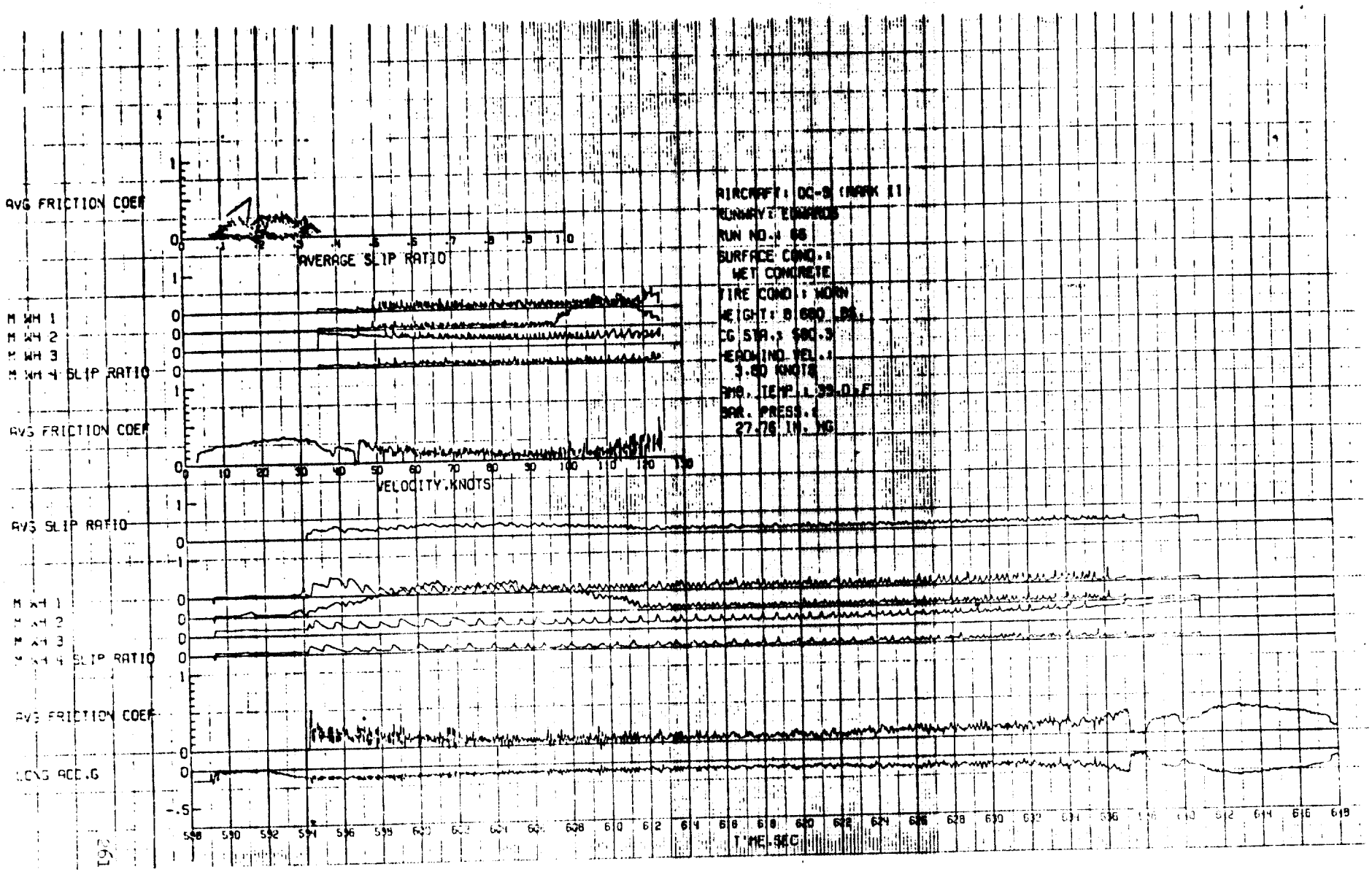

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC,G
TIME,SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: EDWARDS
RUN NO.: 64
SURFACE COND.:
DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 73160 LBS.
CG STA.: 582.0
HEADWIND VEL.:
0.00 KNOTS
AMB. TEMP.: 62.0 F
BAR. PRESS.:
27.71 IN. HG

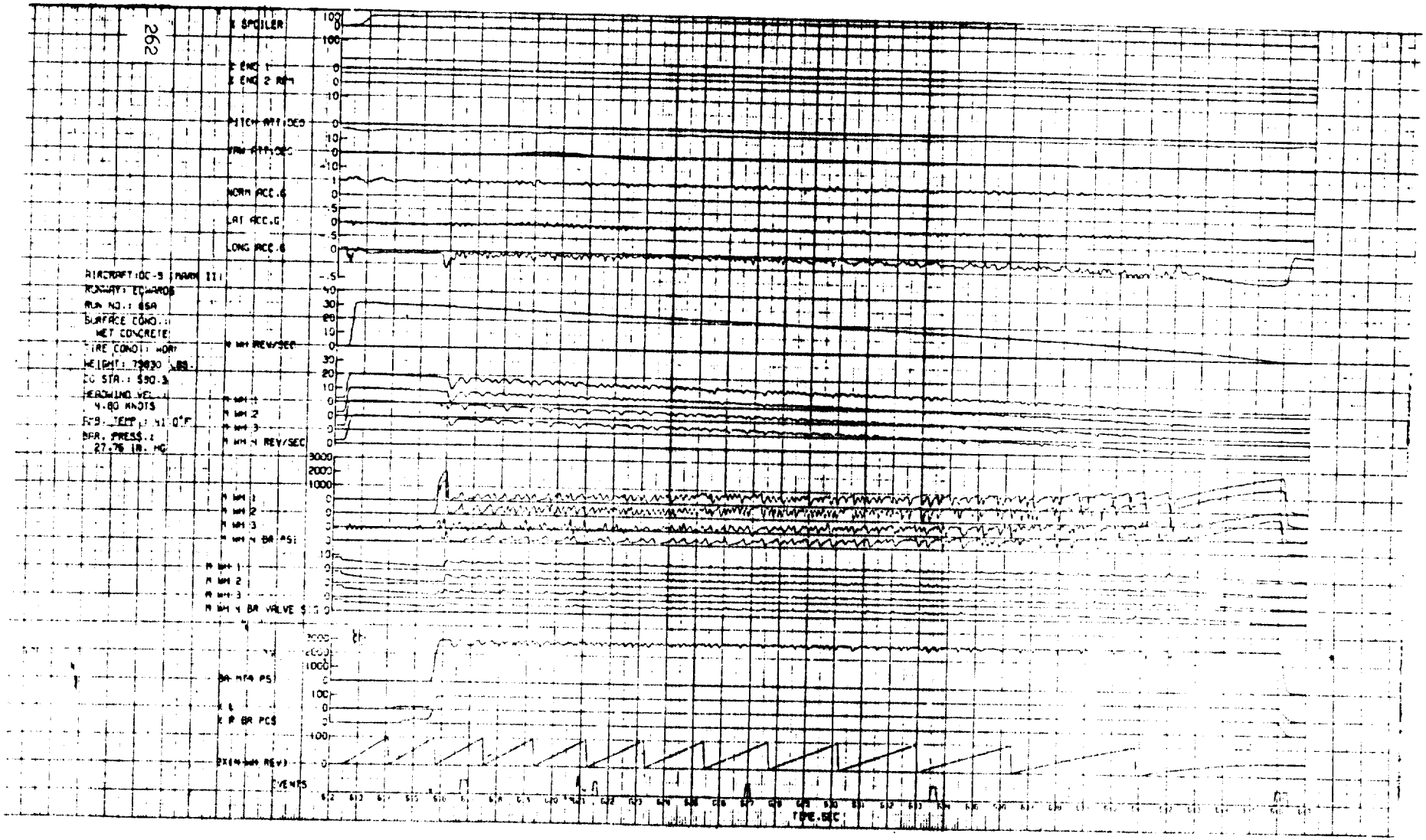

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT: DC-9 (MARK II)
RUNWAY: EDWARDS
RUN NO.: 65
SURFACE COND.: DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 65960 LBS.
CG STA.: 582.3
HEADWIND VEL.: -2.00KNOTS
AMB. TEMP.: 68.0°F
BAR. PRESS.: 27.74 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE SIG
BR MSR PS
% L
% R BR PCS
PIN WH RTVT
EVENTS
TIME,SEC

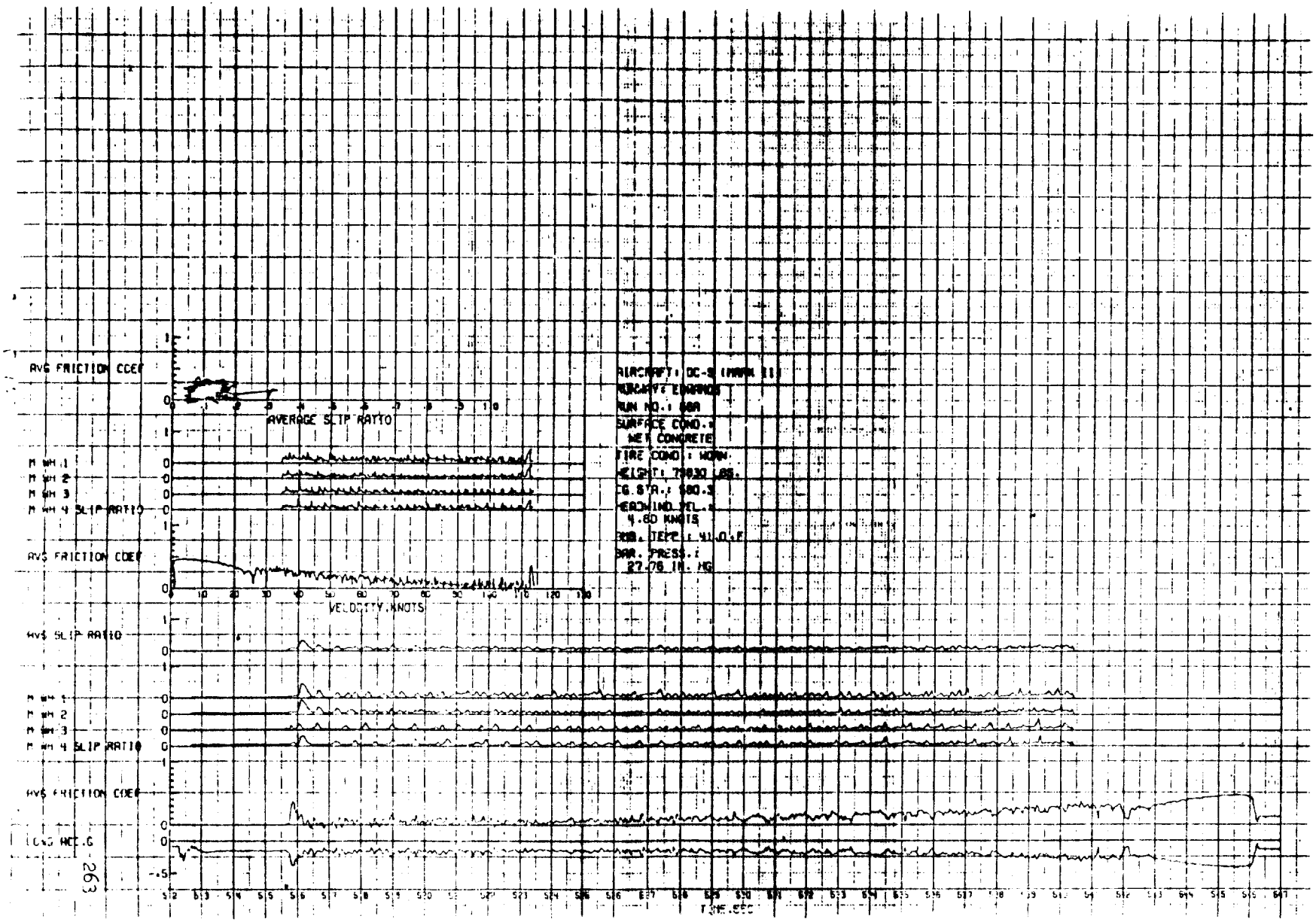

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: EDWARDS
RUN NO.: 65
SURFACE COND.: DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 65860 LBS.
CG STA.: 582.3
HEADWIND VEL.: -2.00 KNOTS
AMB. TEMP.: 68.0 F
BAR. PRESS.: 27.74 IN. HG

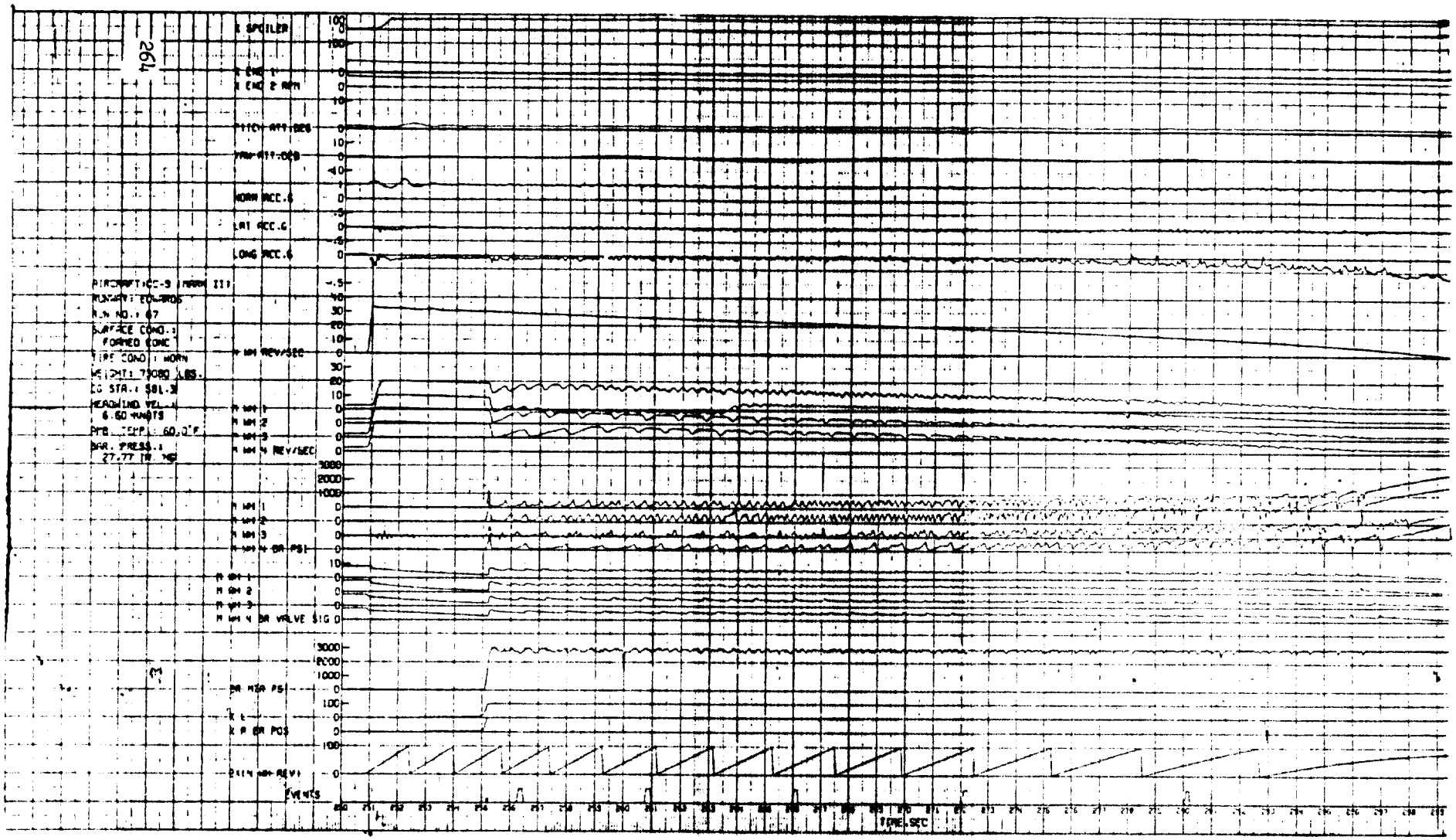
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ORIGINAL PAGE IS POOR

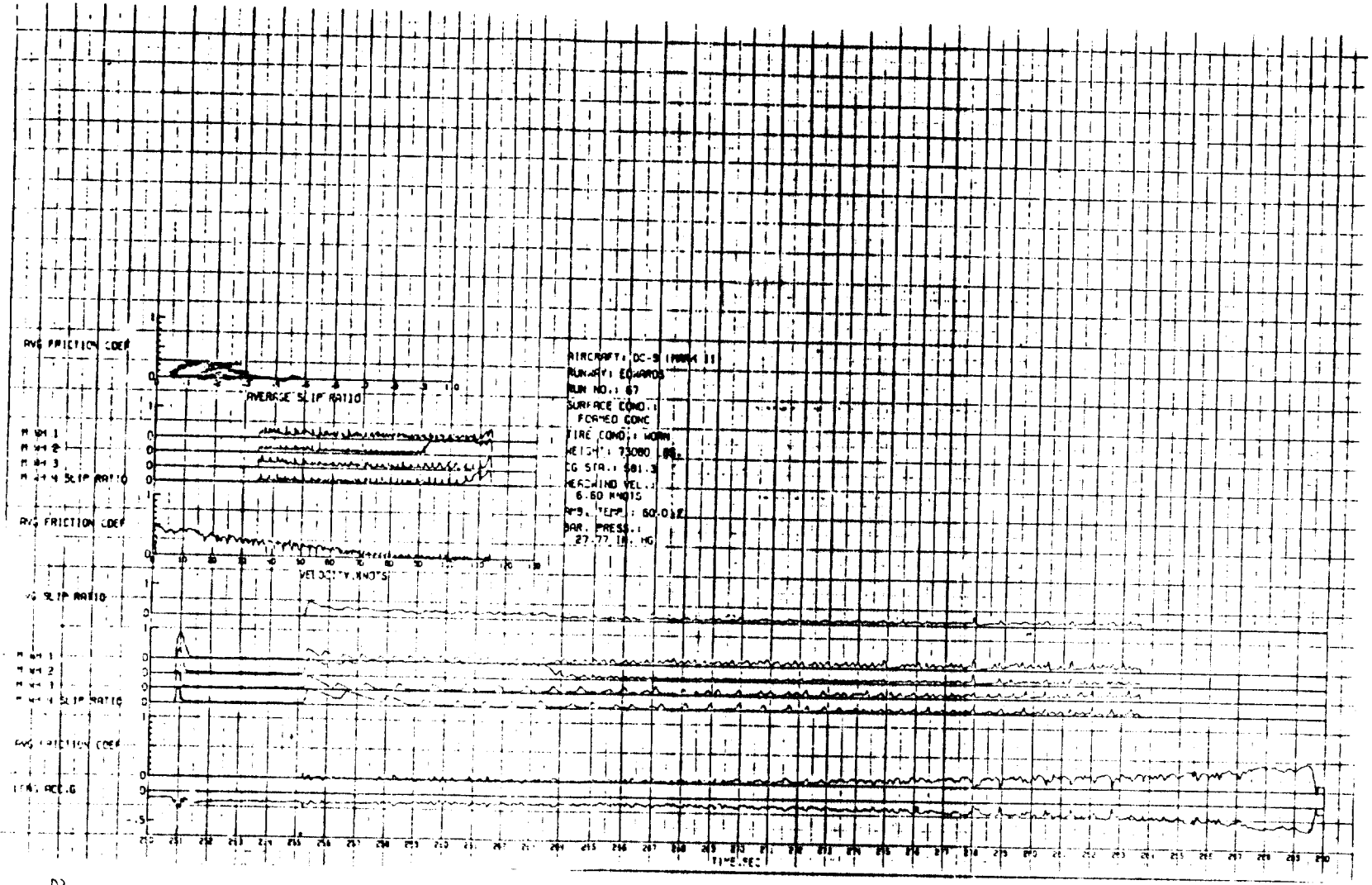


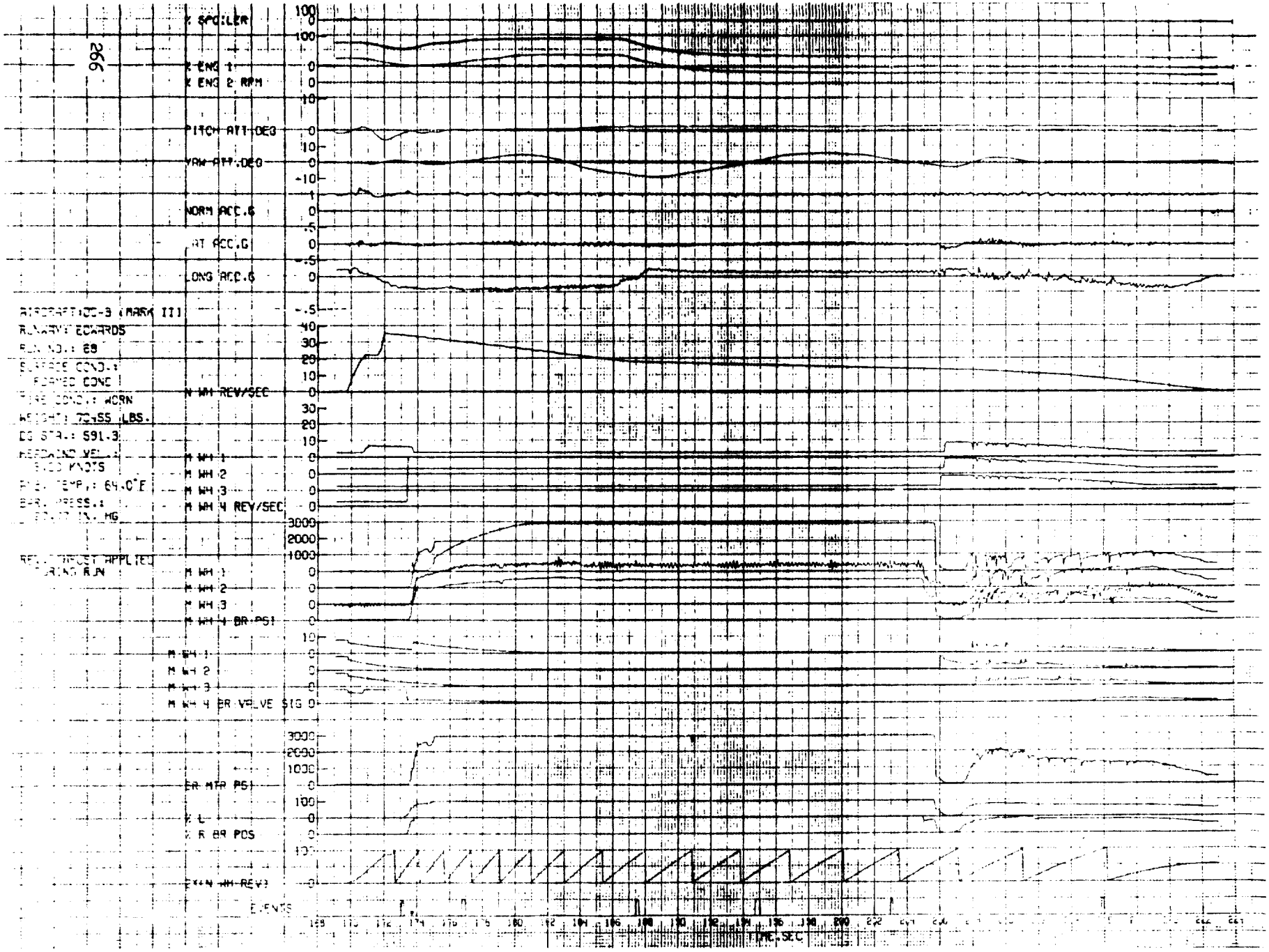

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: EDWARDS
RUN NO.: 66
SURFACE COND.:
WET CONCRETE
TIRE COND.: WORN
WEIGHT: 0 000 LBS.
CG STA.: 590.3
HEADWIND VEL.:
3.60 KNOTS
AMB. TEMP.: 39.0 F
BAR. PRESS.:
27.76 IN. HG

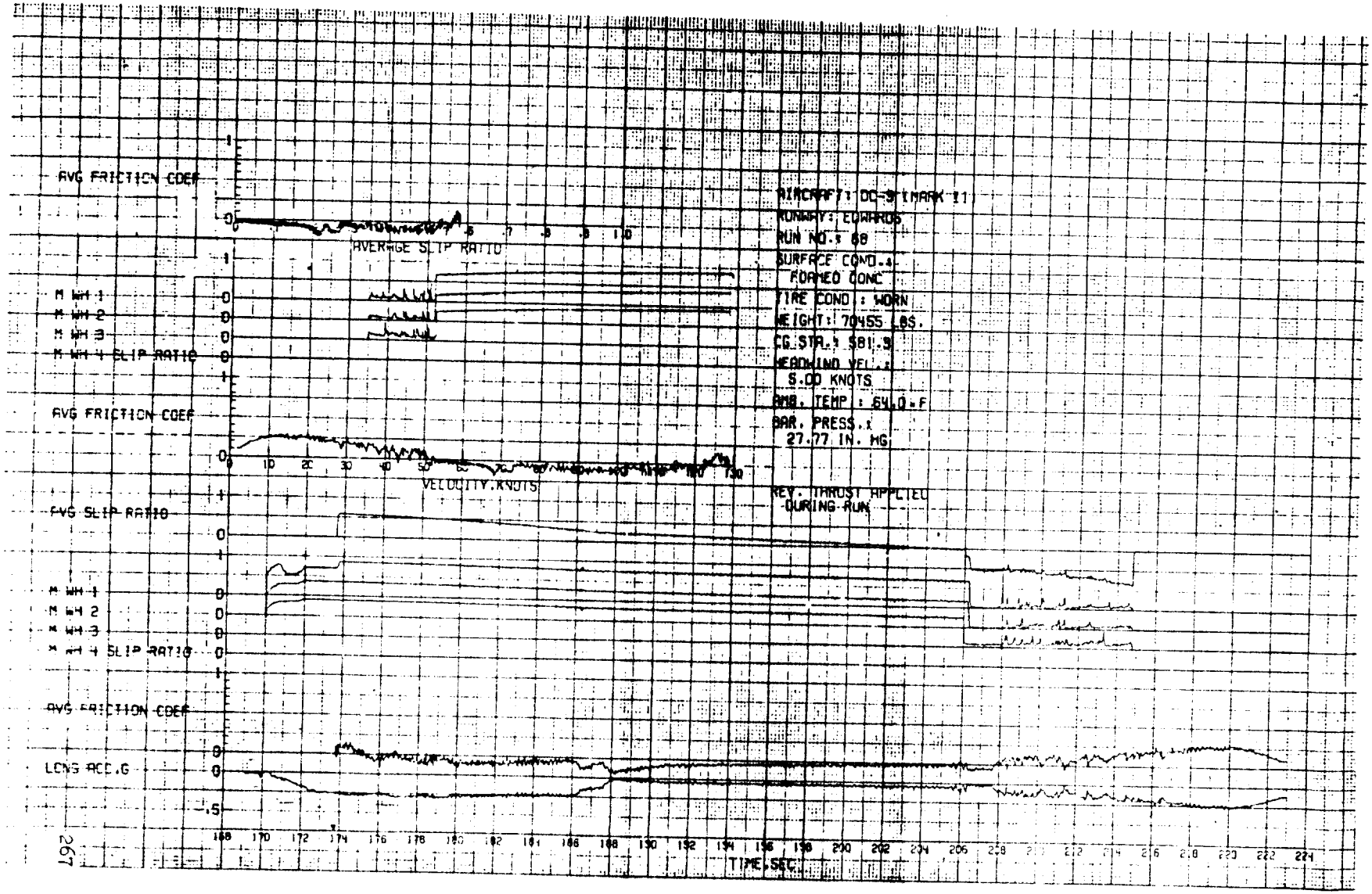

% SPOILER
% END 1
% END 2 RET
PITCH ATT;DEG
YAW ATT;DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:OC-9 (MARK III)
RUNWAY: EDWARDS
RUN NO.: 65A
SURFACE COND.:
WET CONCRETE
TIRE COND.: NOR
WEIGHT: 79030 LBS.
CG STA.: 590.3
HEADWIND VEL.:
4.80 KNOTS
AMB. TEMP.: 41.0°F
BAR. PRESS.:
27.76 IN. HG
N MM REV/SEC
N MM 1
N MM 2
N MM 3
N MM 4 REV/SEC
N MM 1
N MM 2
N MM 3
N MM 4 BR PSI
N MM 1
N MM 2
N MM 3
N MM 4 BR VALVE
BR MTR PSI
L P BR PCS
PX(4-bit REV)
EVENTS
TIME,SEC

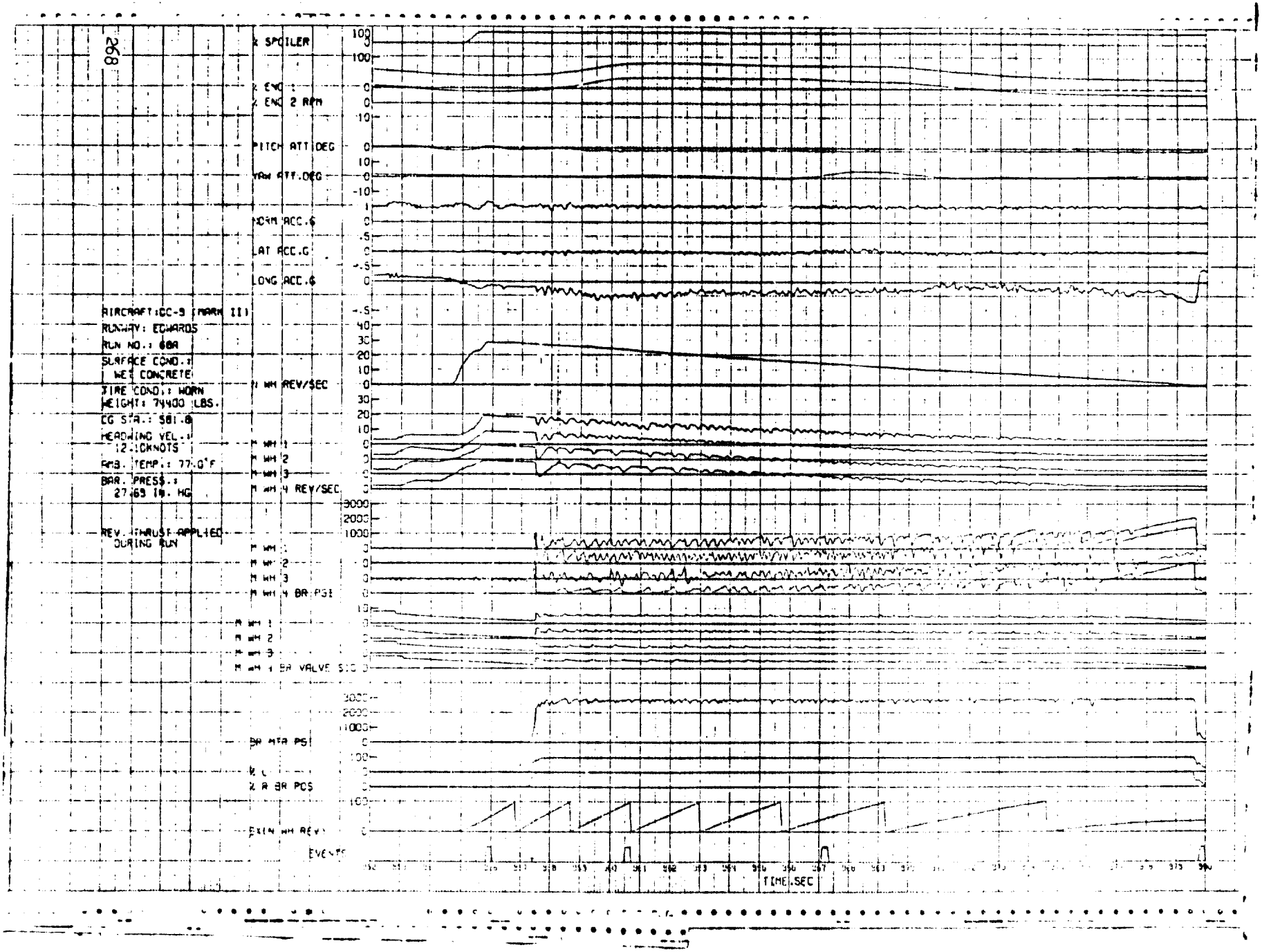

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY, KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK II)
RUN NO.: 68A
SURFACE COND.:
WET CONCRETE
TIRE COND.: WORN
WEIGHT: 79830 LBS.
C.G. STA.: 680.3
HEADWIND VEL.:
9.80 KNOTS
AMB. TEMP.: 41.0 F
BAR. PRESS.:
27.76 IN. HG

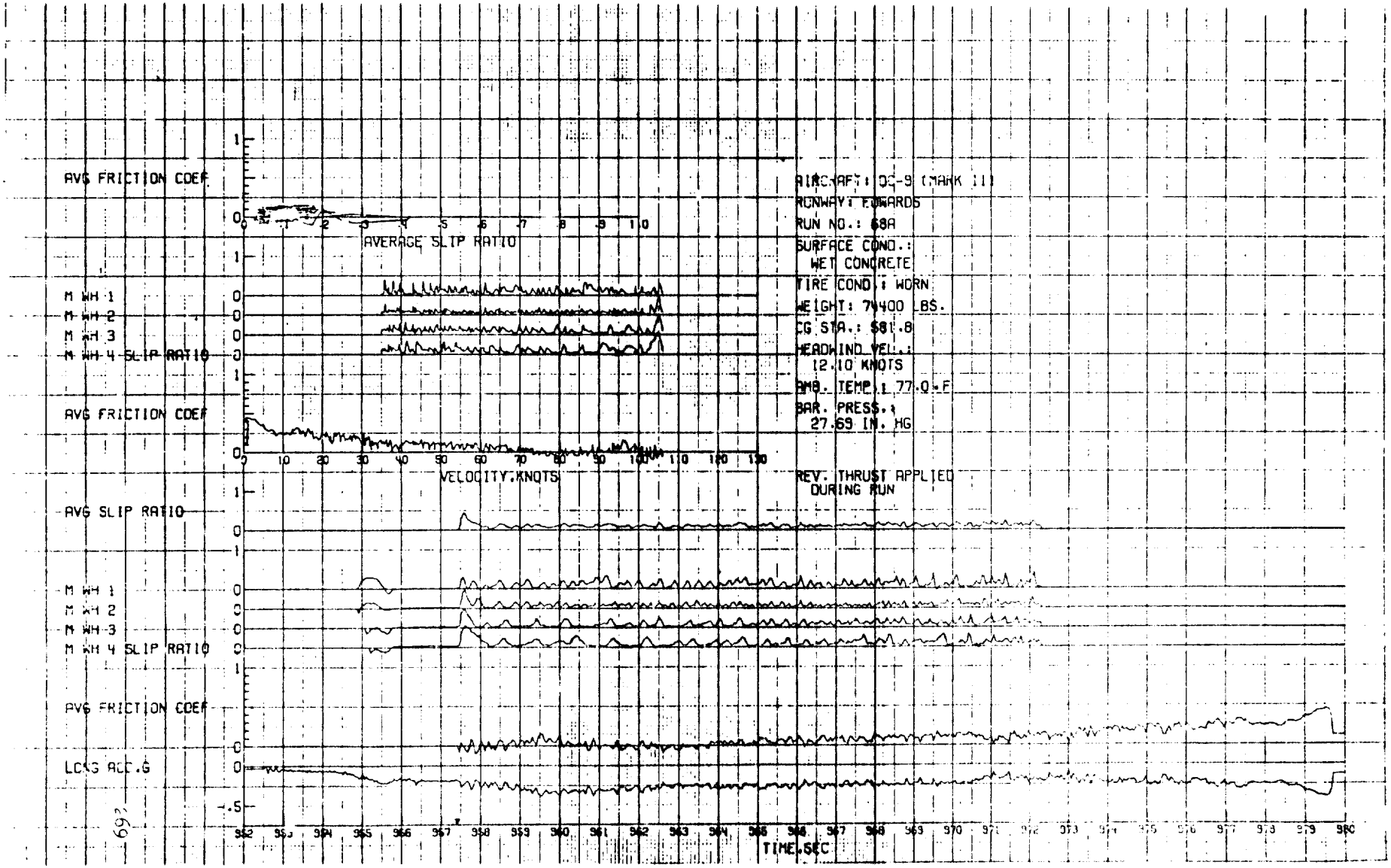

264
L SPOILER
R ENG 1
R ENG 2 RPM
PITCH RATE DEG
YAW RATE DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
R WH REV/SEC
R WH 1
R WH 2
R WH 3
R WH 4 REV/SEC
R WH 1
R WH 2
R WH 3
R WH 4 BR PSI
R WH 1
R WH 2
R WH 3
R WH 4 BR VALVE SIG
BR MSR PSI
L P
R P BR POS
SPIN (REV)
EVENTS
TIME.SEC
AIRCRAFT: CC-9 (MARK III)
RUNWAY: EDWARDS
RUN NO.: 67
SURFACE COND.: FORMED CONC
TIRE COND: NORM
WEIGHT: 79080 LBS.
CG STA.: 581.3
HEADWIND VEL.: 6.60 KNOTS
AMB. TEMP.: 60.0°F
BAR. PRESS.: 27.77 IN HG


AVG FRICTION COEF
AVERAGE SLIP RATIO
WHEEL 1
WHEEL 2
WHEEL 3
WHEEL 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
WHEEL 1
WHEEL 2
WHEEL 3
WHEEL 4 SLIP RATIO
AVG FRICTION COEF
LONG. ACC.G
TIME,SEC
AIRCRAFT: DC-9 (PARA II)
RUNWAY: EDWARDS
RUN NO.: 67
SURFACE COND.:
FORMED CONC
TIRE COND.: WORN
WEIGHT: 73080 LBS
CG STA.: 581.3
HEADWIND VEL.:
6.60 KNOTS
AMB. TEMP.: 60.0°F
BAR. PRESS.:
27.77 IN. HG


% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LONG ACC.G
N WH REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 BR PSI
M WH 1
M WH 2
M WH 3
M WH 4 BR VALVE SIG
BR MTR PSI
% L
% R BR POS
EVENTS
TIME,SEC

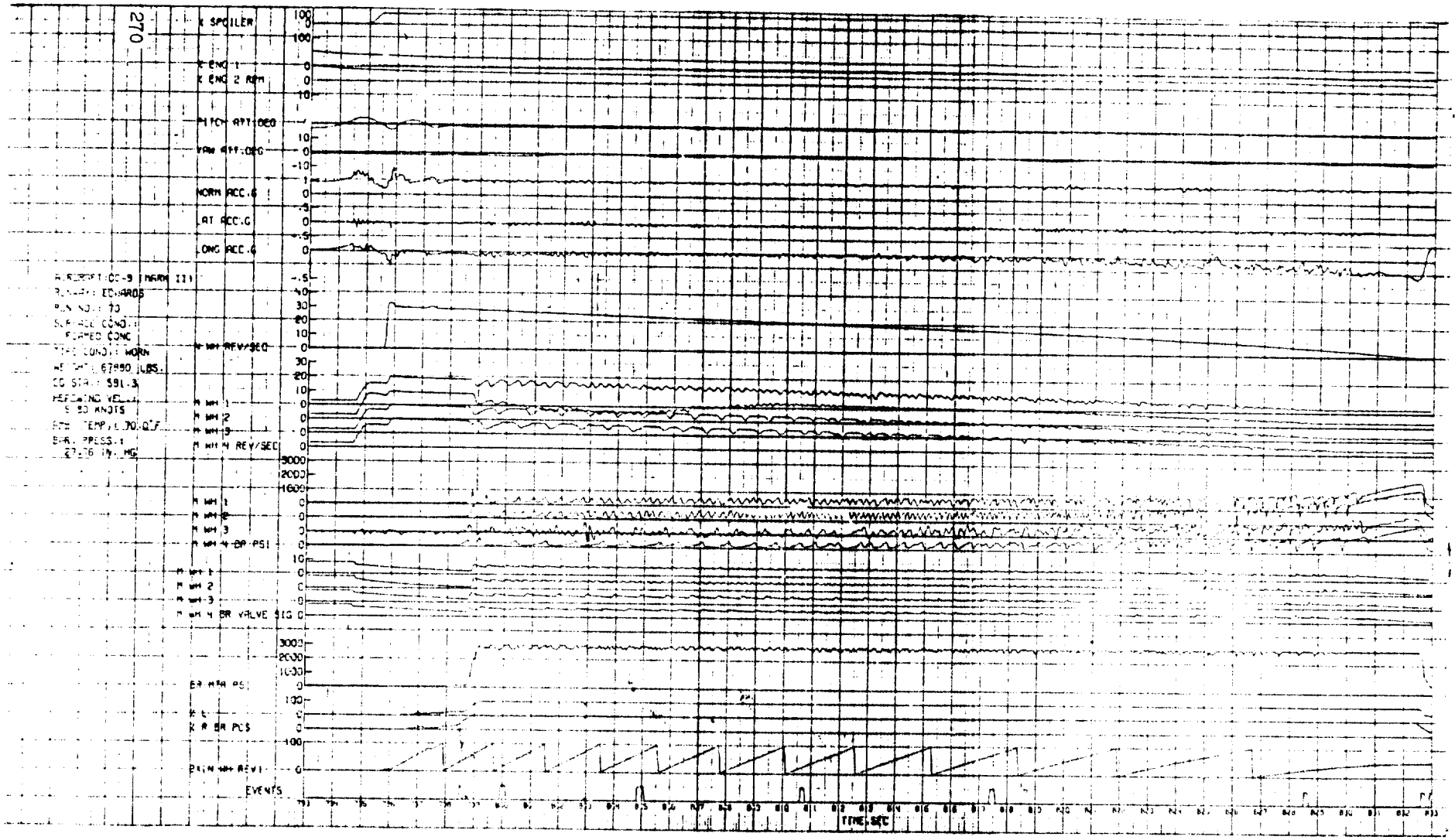

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC.
AIRCRAFT: DC-9 MARK II
RUNWAY: EDWARDS
RUN NO.: 68
SURFACE COND.: FOAMED CONC
TIRE COND.: WORN
WEIGHT: 70455 LBS.
CG STA.: 581.9
HEADWIND VEL.: 5.00 KNOTS
AMB. TEMP.: 64.0 F
BAR. PRESS.: 27.77 IN. HG
REV. THRUST APPLIED DURING RUN

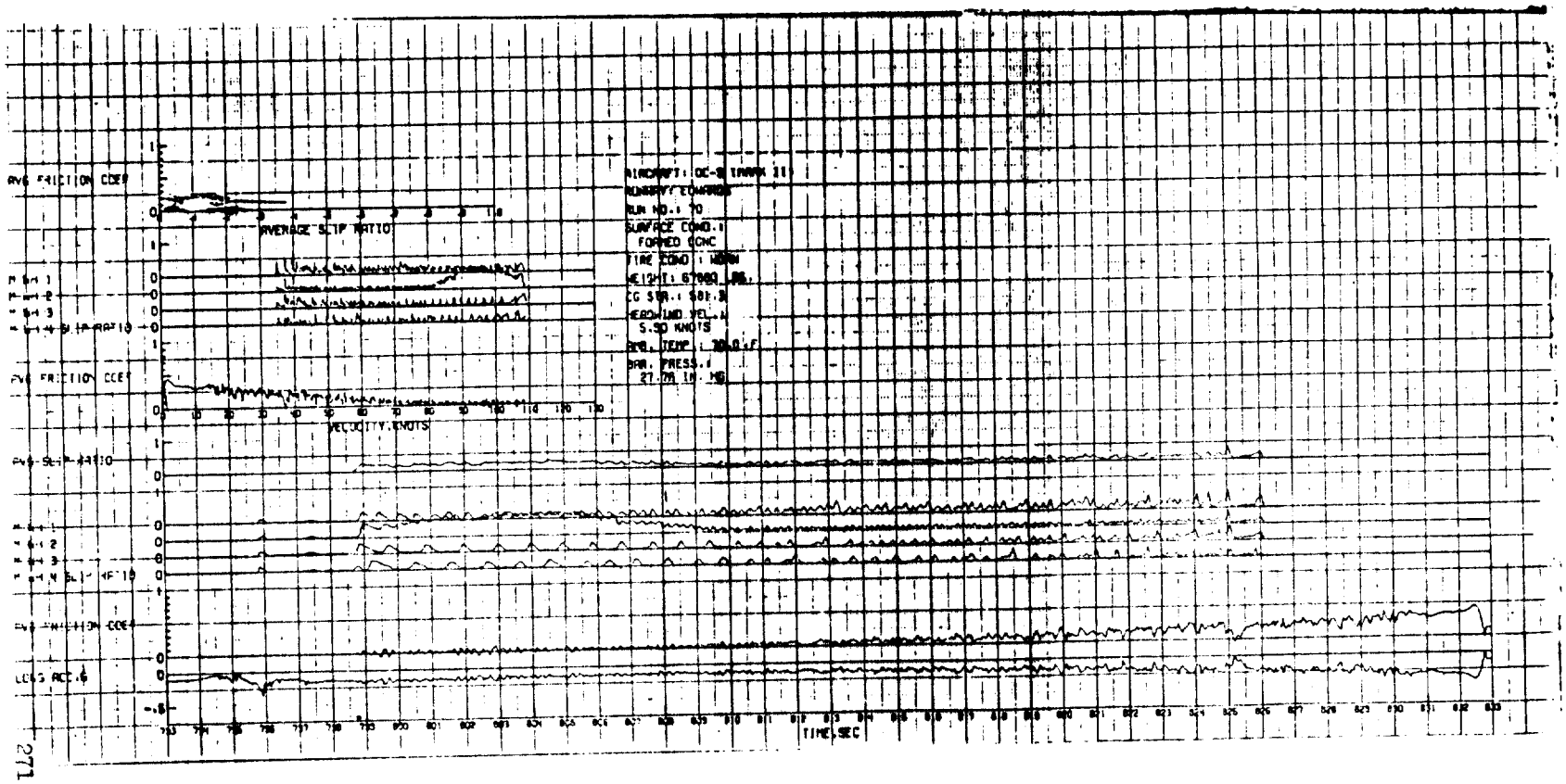

288
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-9 (MARK II)
RUNWAY: EDWARDS
RUN NO.: 68A
SURFACE COND.:
WET CONCRETE
TIRE COND.: WORN
WEIGHT: 74400 LBS.
CG STA.: 581.8
HEADWIND VEL.:
12.1KNOTS
AMB. TEMP.: 77.0°F
BAR. PRESS.:
27.69 IN. HG
REV. THRUST APPLIED
DURING RUN
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE SIG
BR MTR PSI
% L
% R BR POS
EXIN WH REV
EVENTS
TIME,SEC

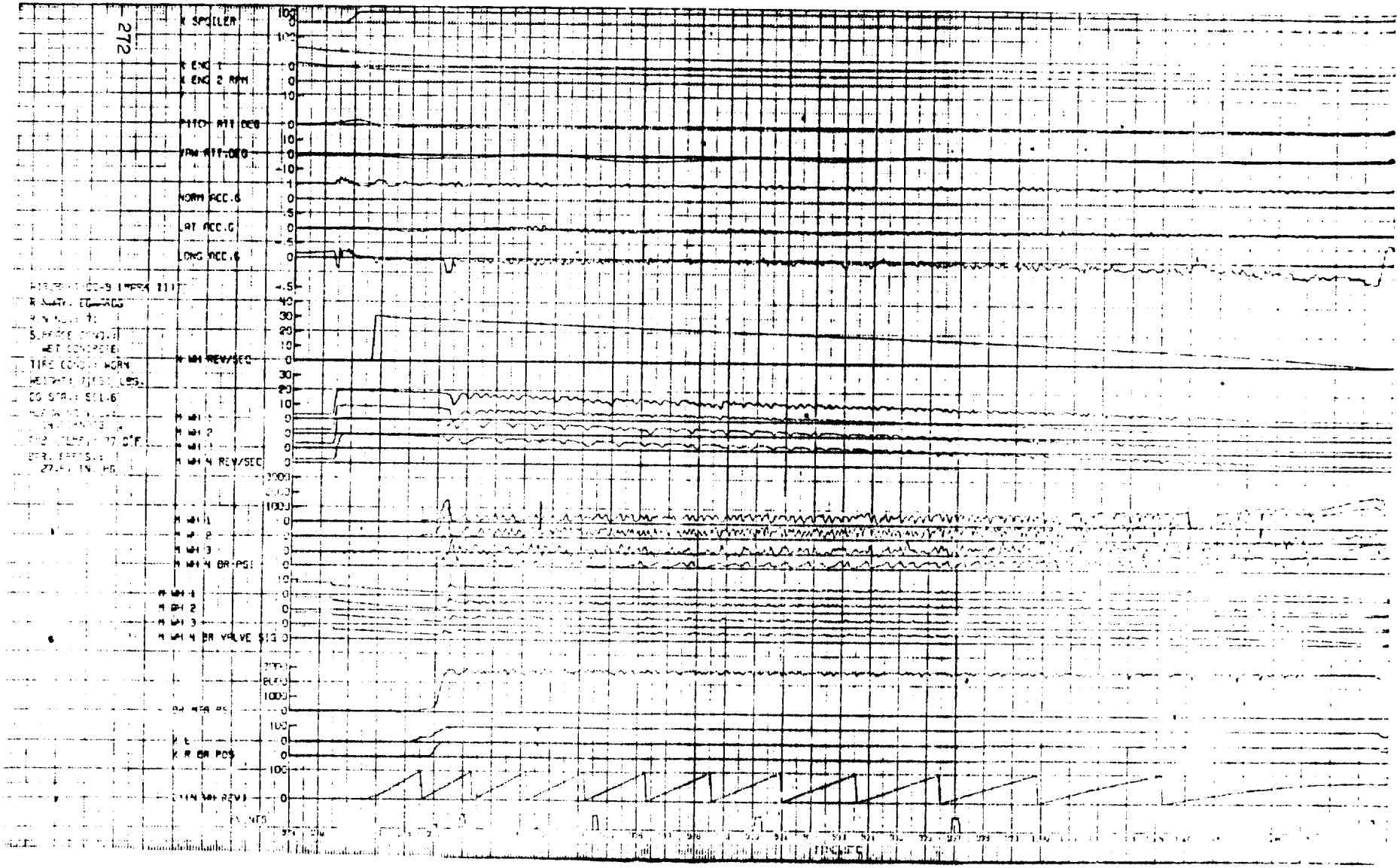


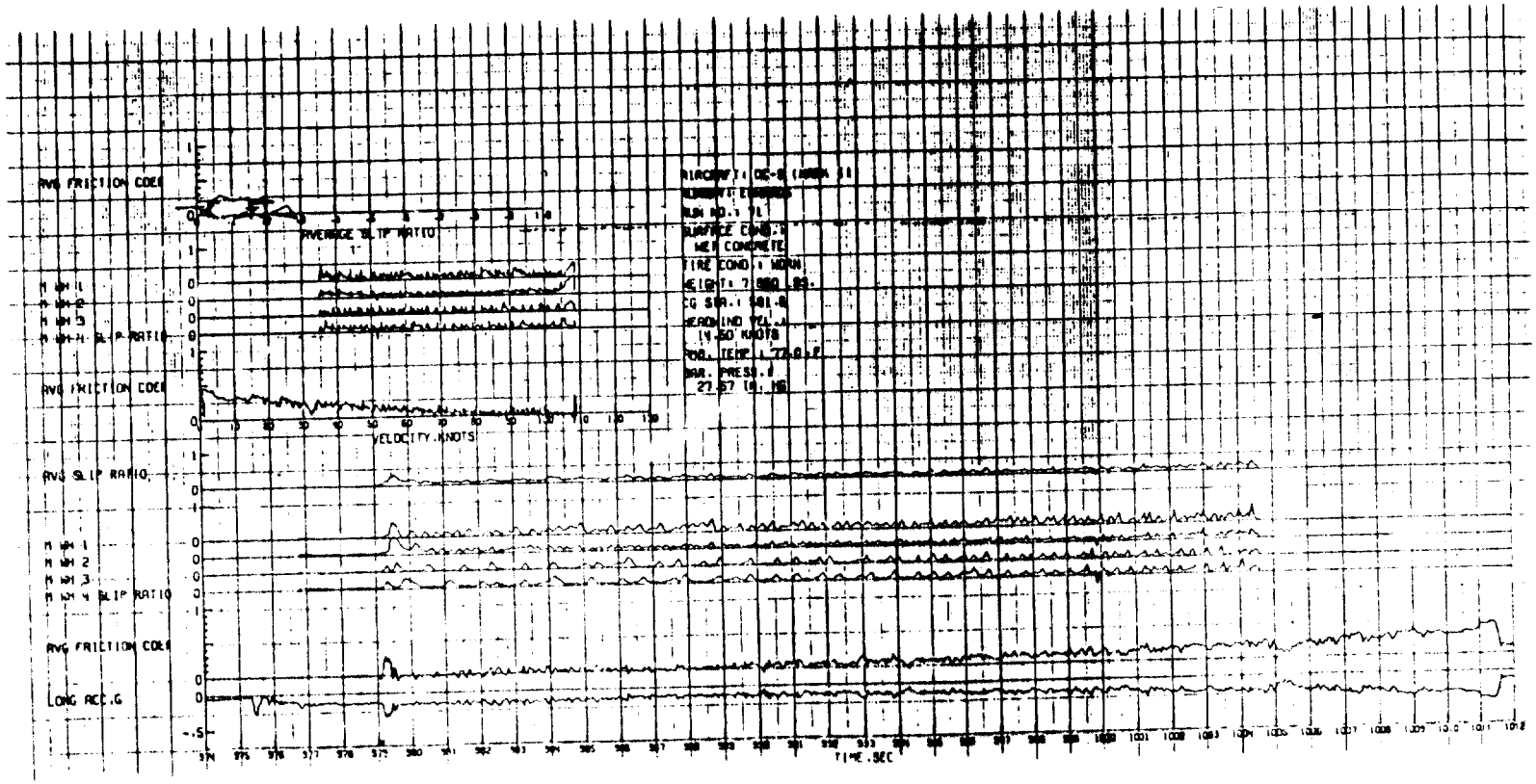
692

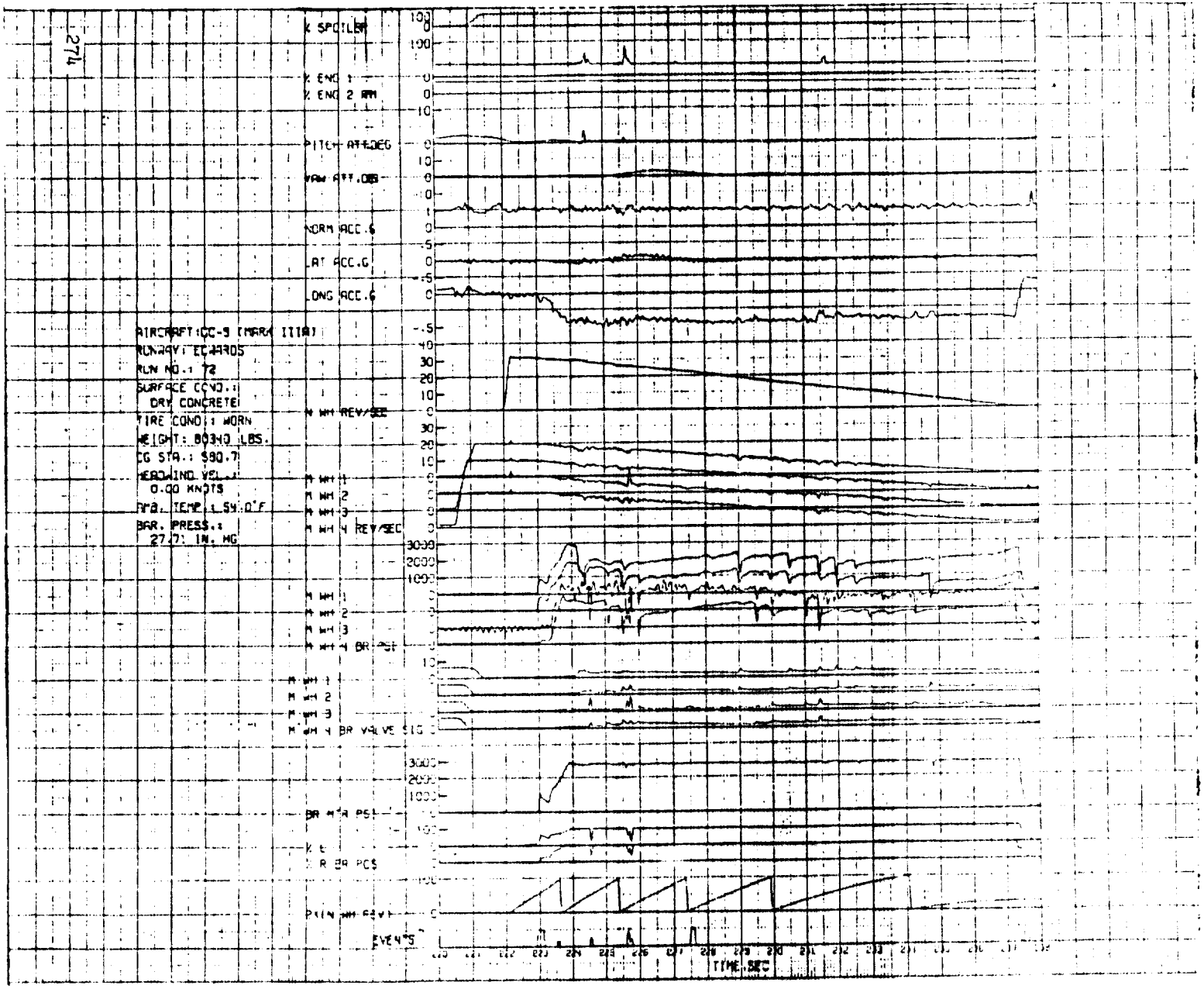
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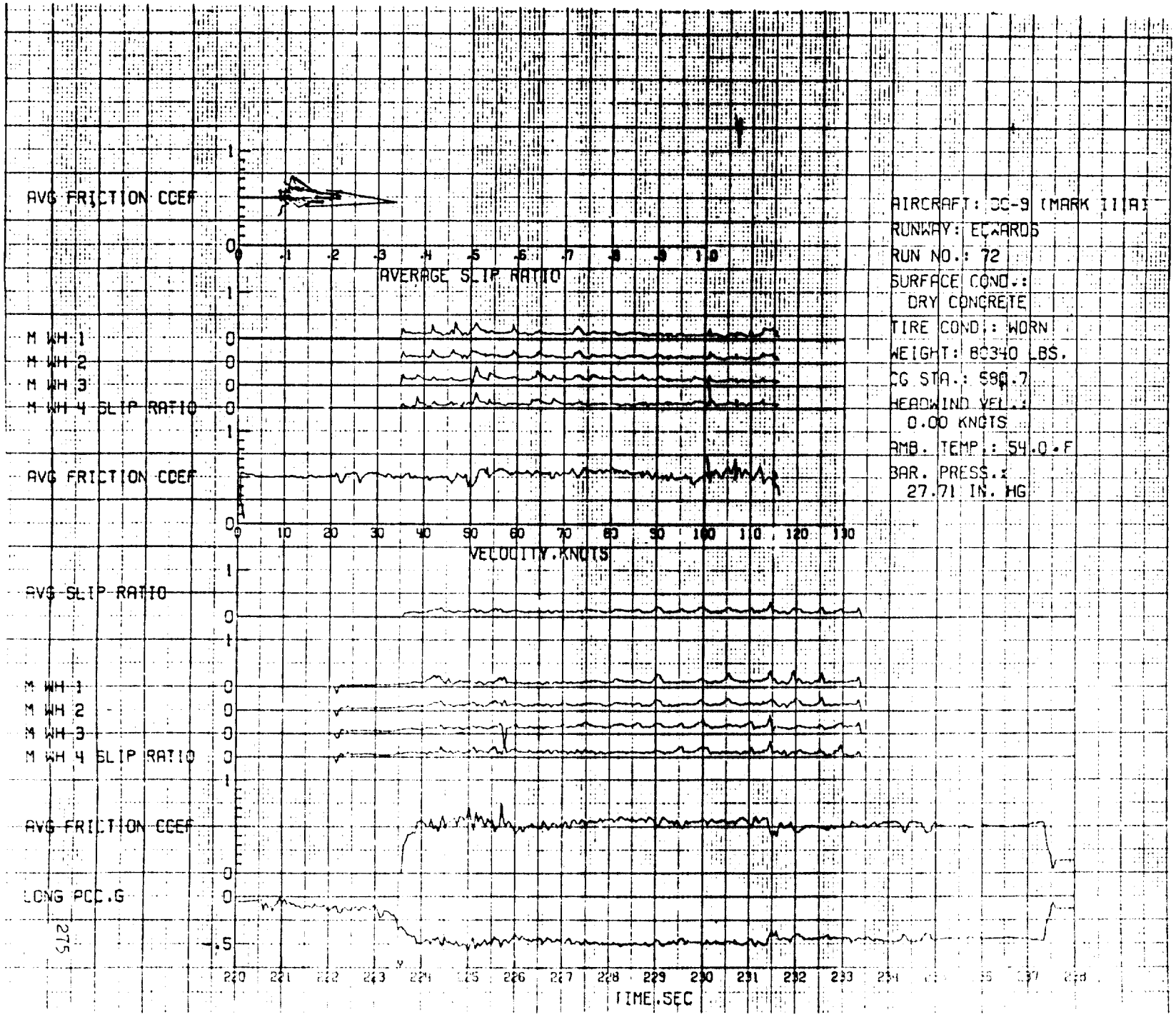

270
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT:DEG
YAW ATT:DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
EVENTS
TIME:SEC


AVERAGE SLIP RATIO
VELOCITY,KNOTS
TIME,SEC

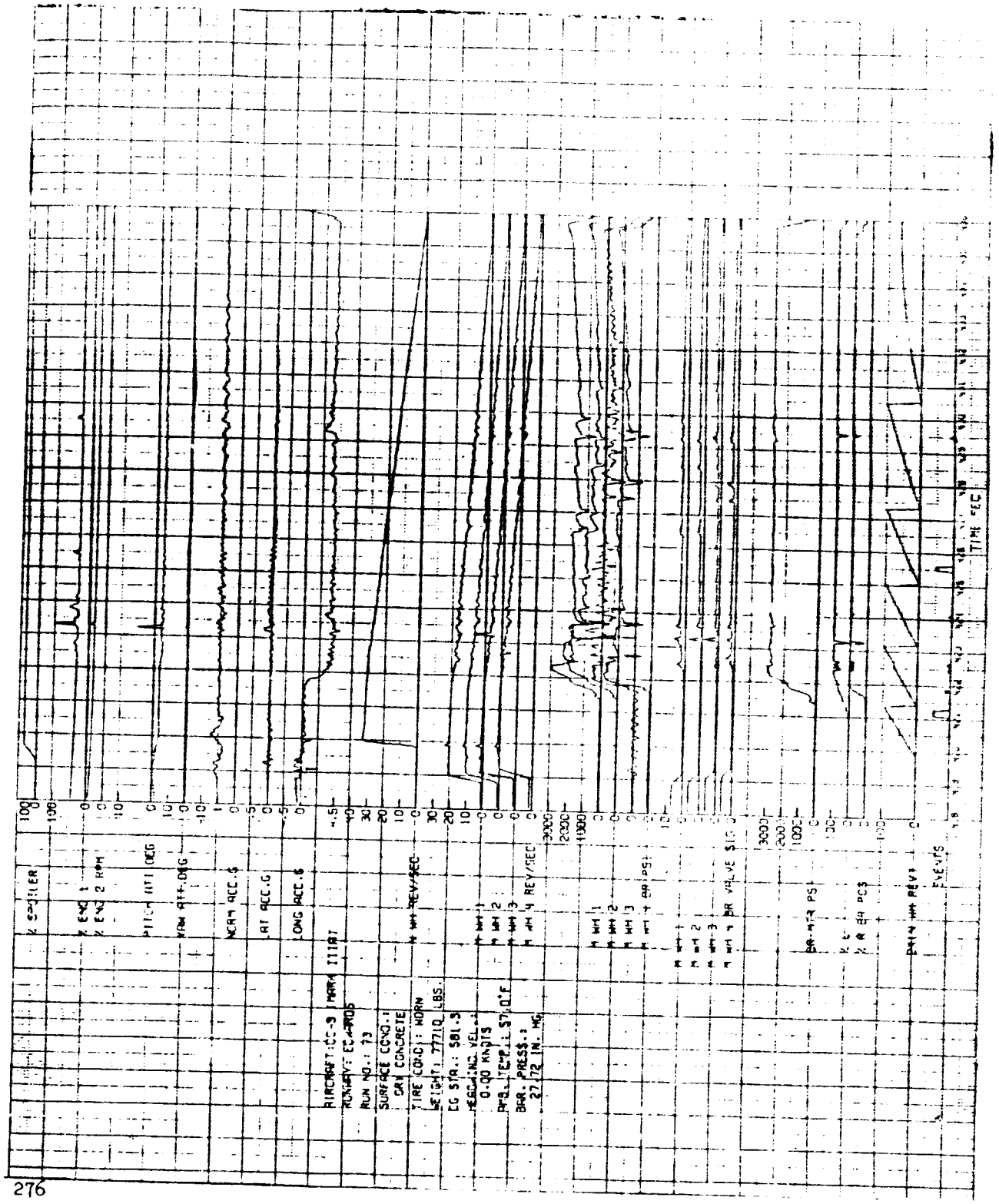

272
R SPOILER
R ENG 1
R ENG 2 RPM
PITCH ATT DEG
YAW ATT DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
R WH REV/SEC
R WH 1
R WH 2
R WH 3
R WH 4 REV/SEC
R WH 1
R WH 2
R WH 3
R WH 4 BR PSI
R WH 1
R WH 2
R WH 3
R WH 4 BR VALVE SIG
R R BR POS
TIME SEC

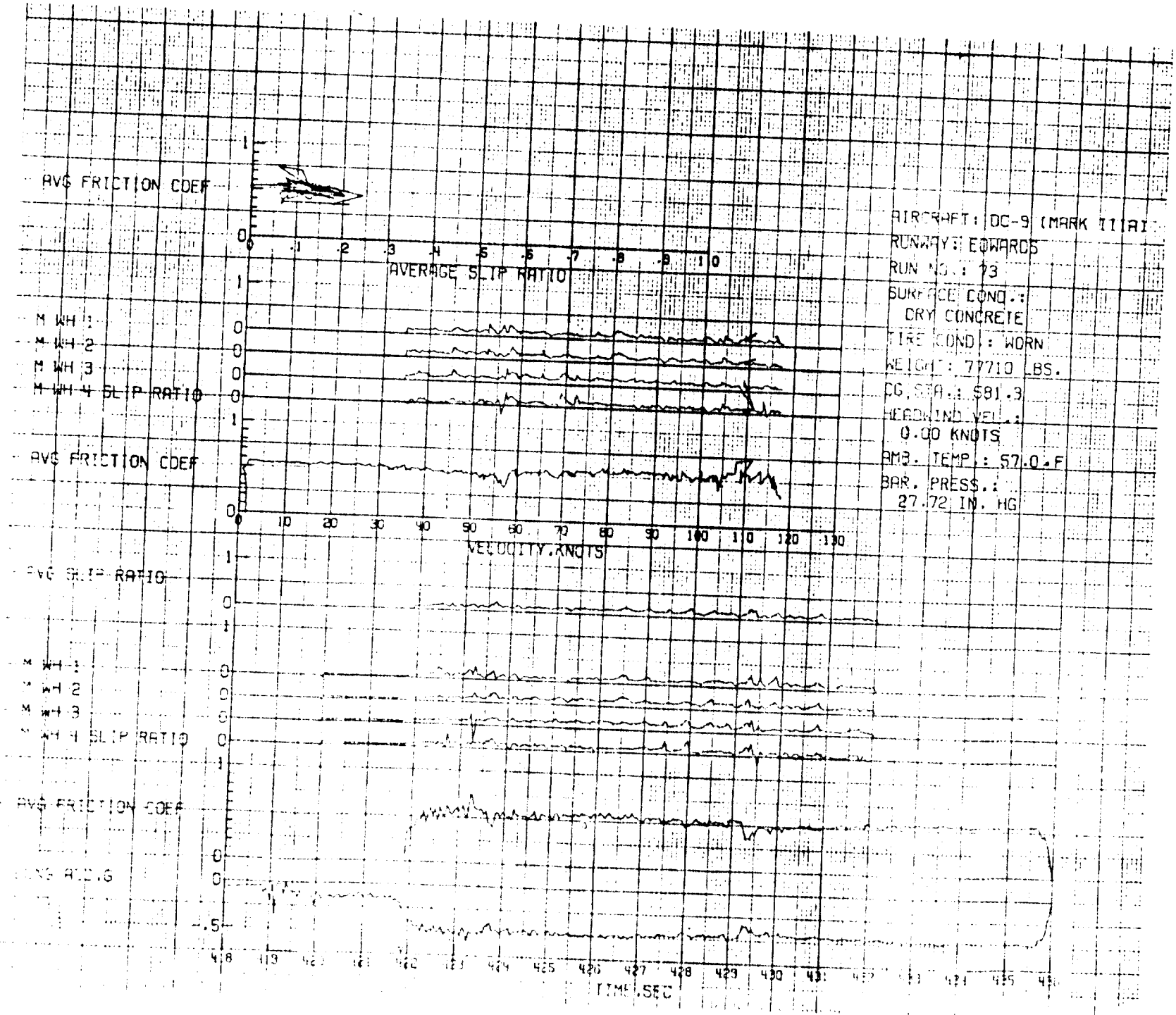

AVG FRICTION COEF
AVERAGE SLIP RATIO
VELOCITY.KNOTS
AVG FRICTION COEF
AVG SLIP RATIO
SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC

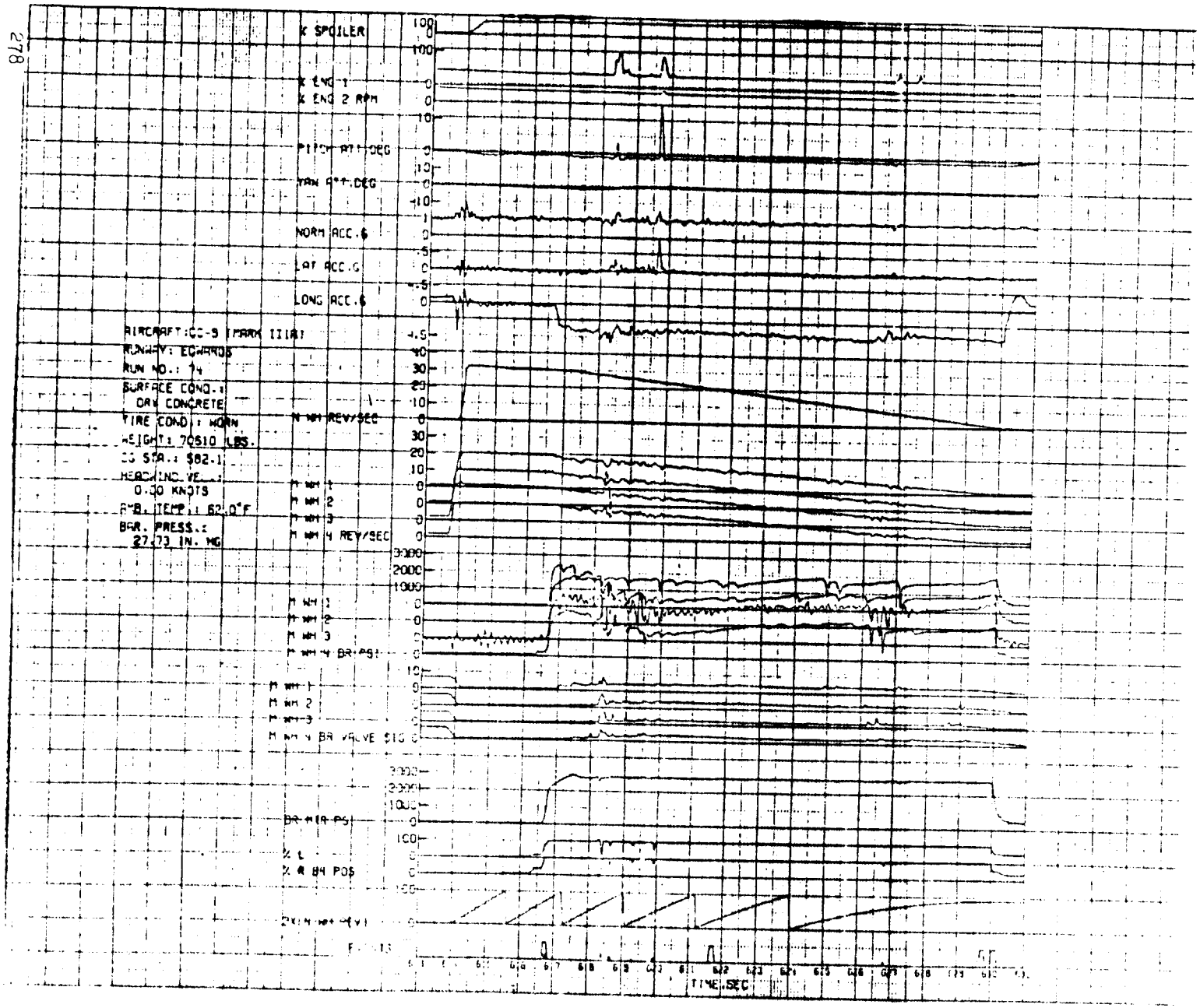

274
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-9 (MARK IIIA)
RUNWAY: EC-RR05
RUN NO.: 72
SURFACE COND.:
DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 80340 LBS.
CG STA.: 980.7
HEADWIND VEL.:
0.00 KNOTS
AMB. TEMP.: 54.0°F
BAR. PRESS.:
27.07 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE SIG
BR MSTR PSI
L R BR PCS
EVENTS
TIME SEC

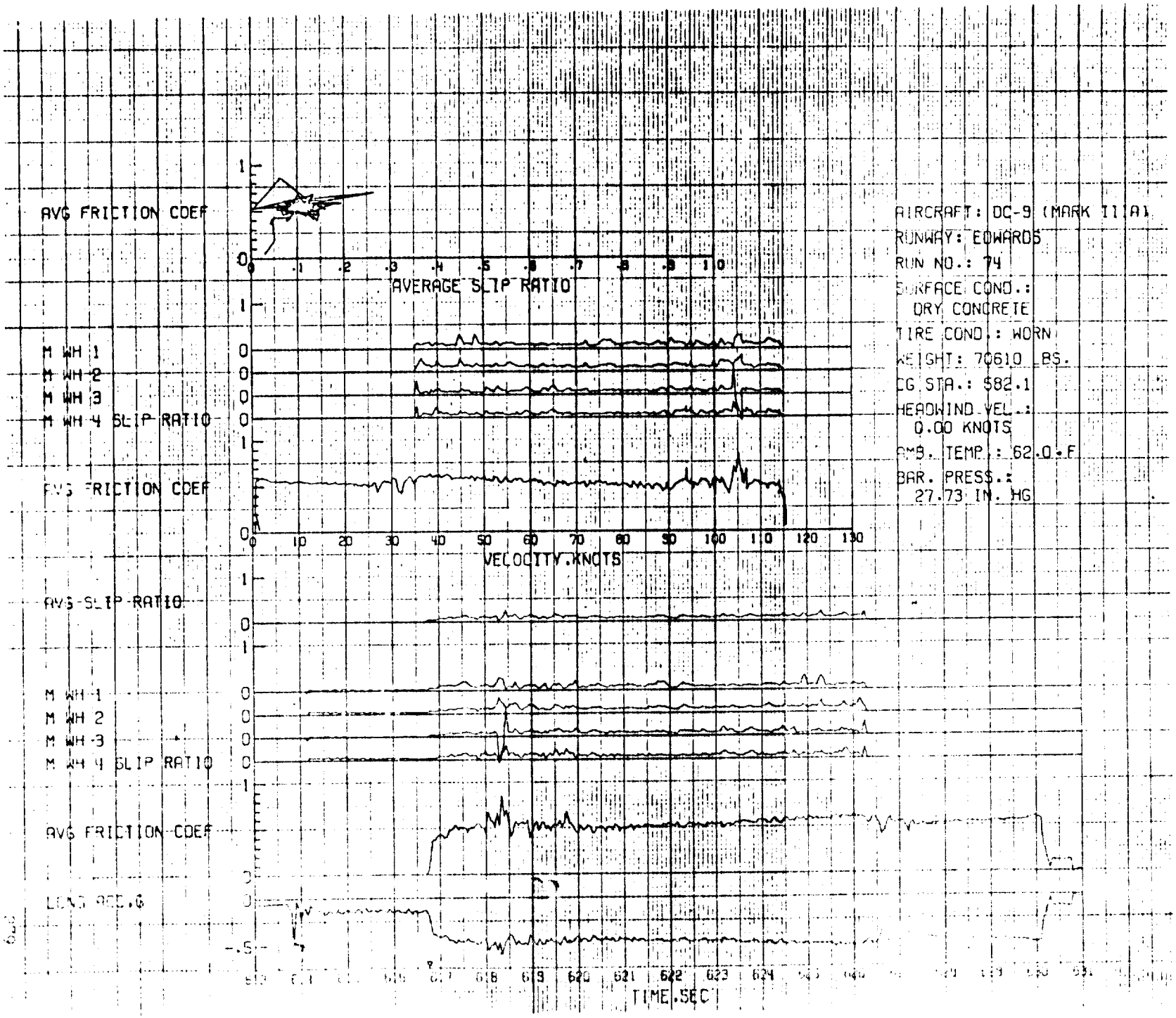

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC
AIRCRAFT: DC-9 (MARK III)
RUNWAY: EDWARDS
RUN NO.: 72
SURFACE COND.:
DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 80340 LBS.
CG STA.: 880.7
HEADWIND VEL.:
0.00 KNOTS
AMB. TEMP.: 54.0 F
BAR. PRESS.:
27.71 IN. HG

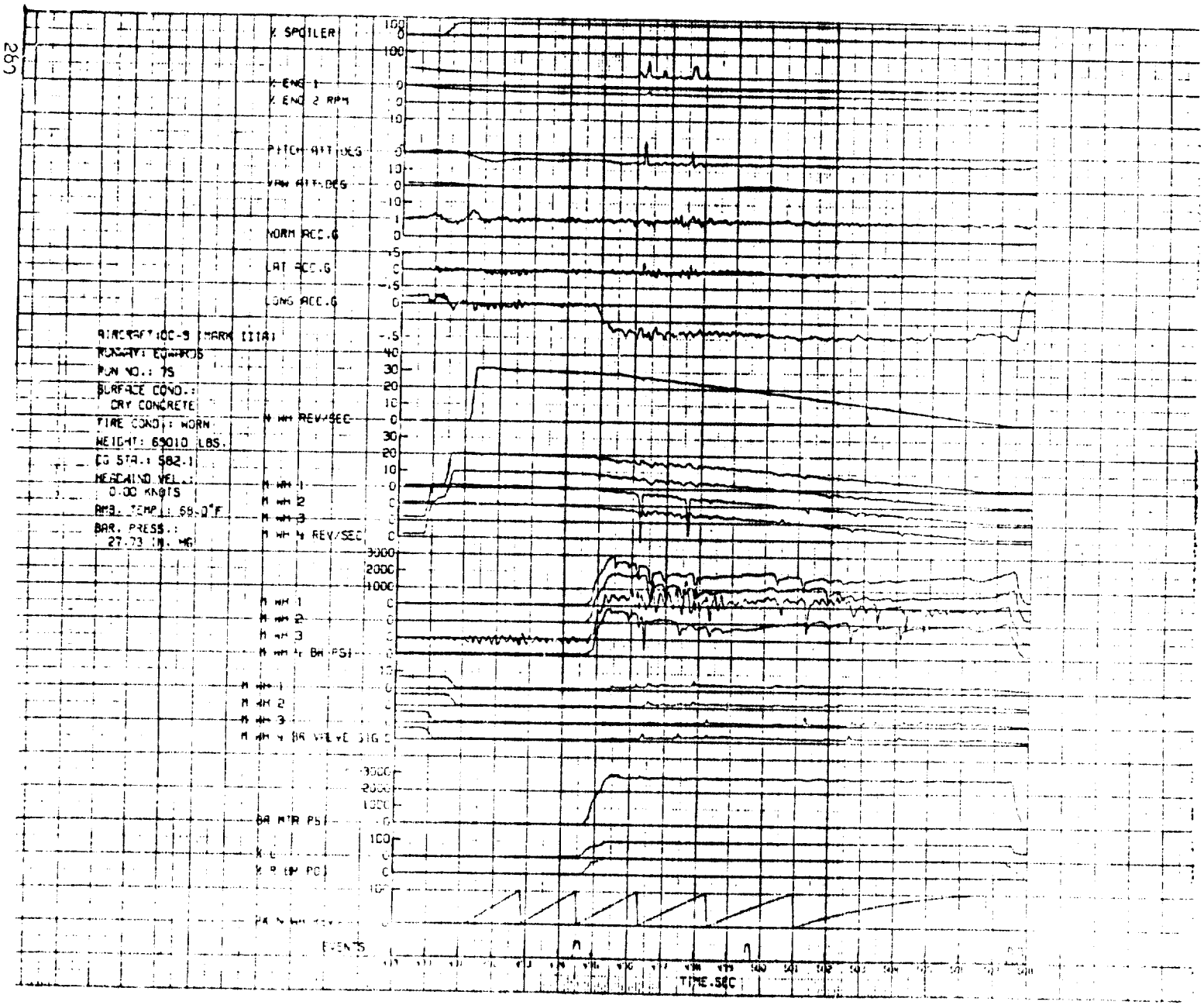
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ORIGINAL PAGE IS POOR

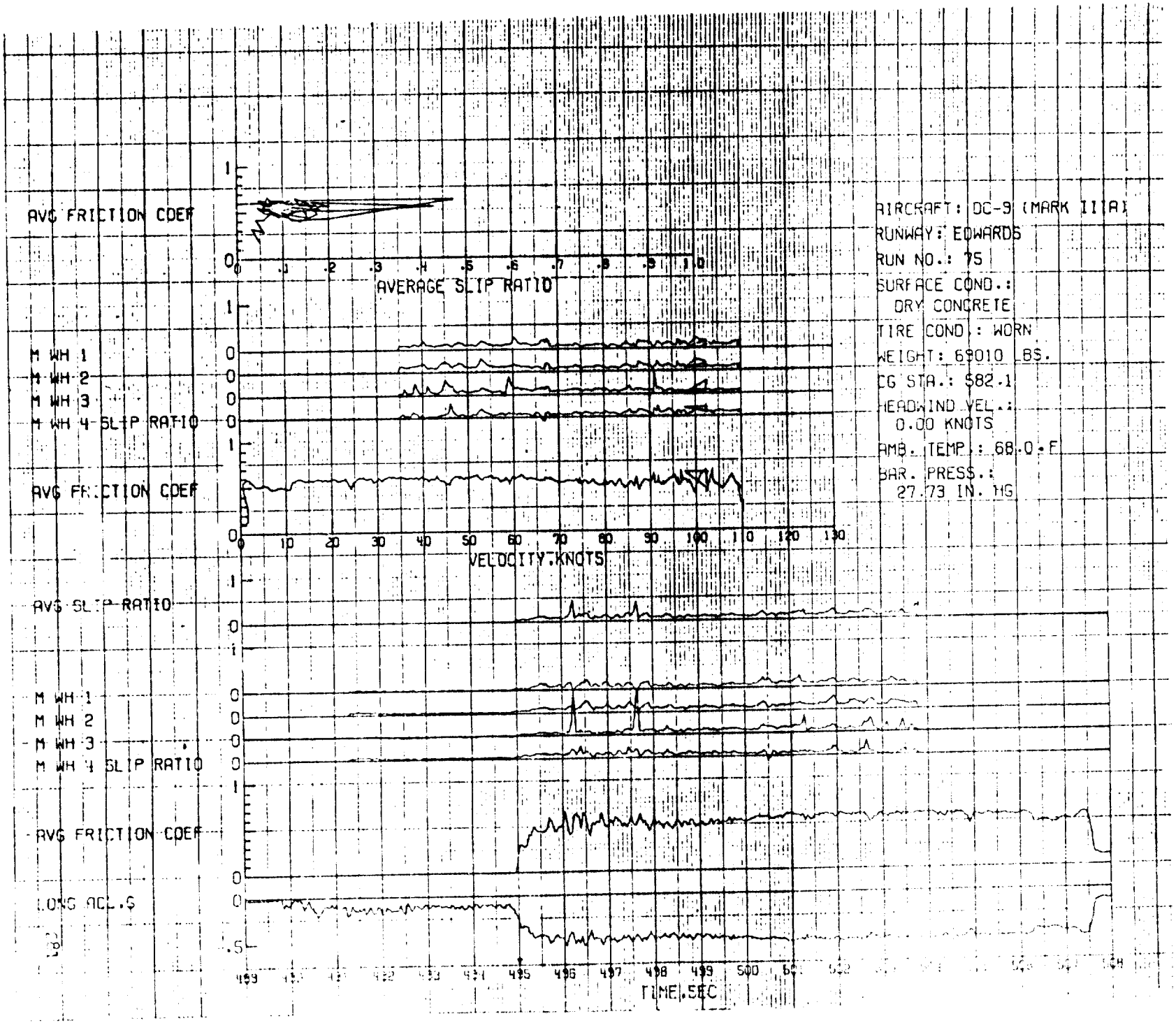


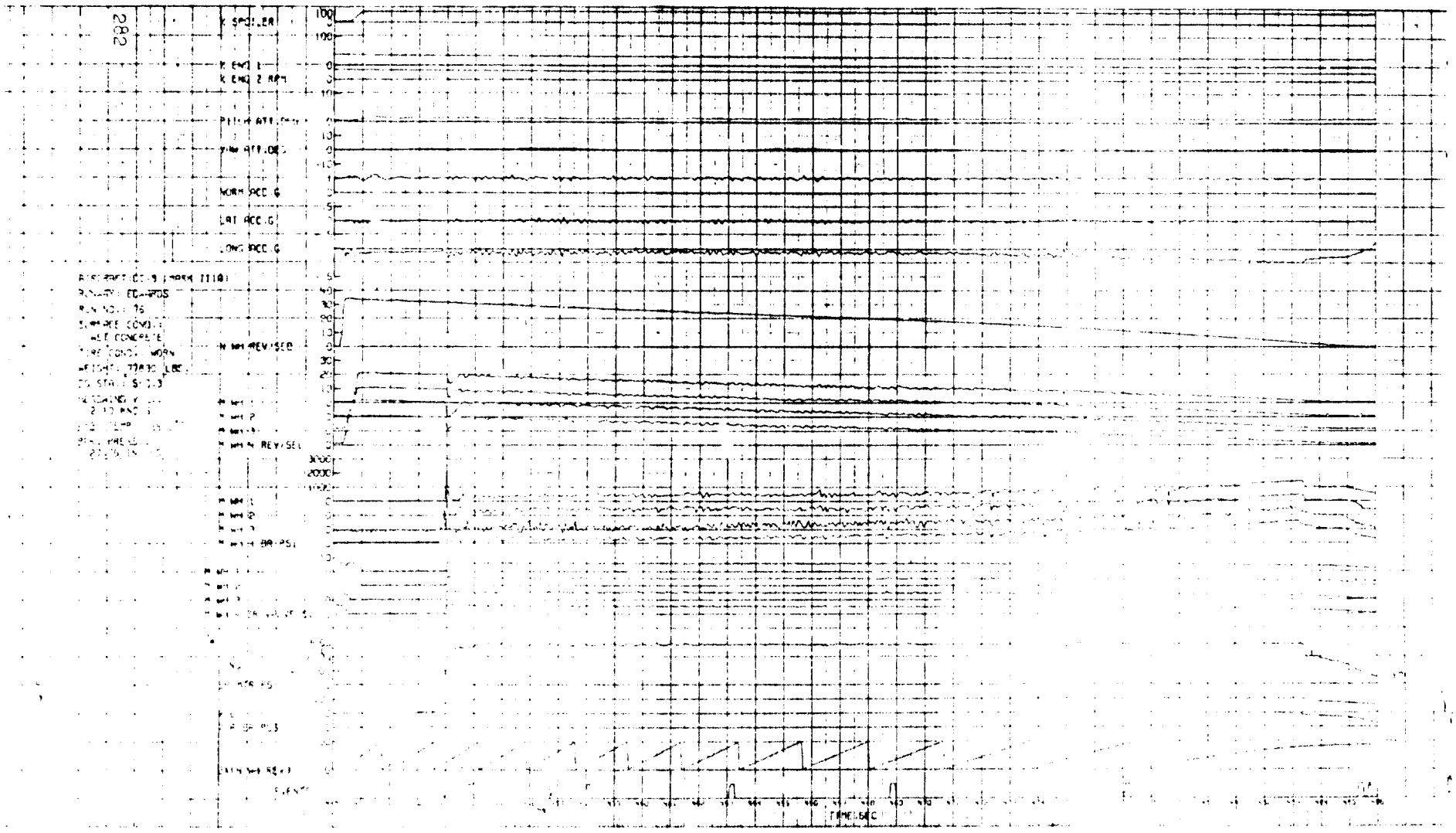

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
TIME,SEC
AIRCRAFT: DC-9 (MARK IIIAI
RUNWAY: EDWARDS
RUN NO.: 73
SURFACE COND.:
DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 77710 LBS.
CG, STA.: 581.3
HEADWIND VEL.:
0.00 KNOTS
AMB. TEMP.: 57.0 F
BAR. PRESS.:
27.72 IN. HG


% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT, DEG
YAW ATT, DEG
NORM ACC, G
LAT ACC, G
LONG ACC, G
AIRCRAFT: CC-9 (MARK IIIA)
RUNWAY: EDWARDS
RUN NO.: 14
SURFACE COND.:
DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 70510 LBS.
CG STA.: 582.1
HEADWIND VEL.:
0.00 KNOTS
AMB. TEMP.: 62.0°F
BAR. PRESS.:
27.73 IN. HG
M WH 1
M WH 2
M WH 3
M WH 4 REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 BR PSI
M WH 1
M WH 2
M WH 3
M WH 4 BR VALVE SIG
BR MTR PSI
% L
% R BH POS
TIME, SEC


AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK II A)
RUNWAY: EDWARDS
RUN NO.: 74
SURFACE COND.:
DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 70610 LBS.
CG STA.: 582.1
HEADWIND VEL.:
0.00 KNOTS
AMB. TEMP.: 62.0 F
BAR. PRESS.:
27.73 IN. HG

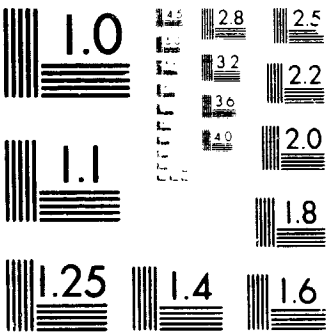

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-9 (MARK IIIA)
RUNWAY: EDWARDS
RUN NO.: 75
SURFACE COND.:
DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 69010 LBS.
CG STA.: 582.1
HEADWIND VEL.:
0.00 KNOTS
AMB. TEMP.: 69.0°F
BAR. PRESS.:
27.73 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VELVE SIG
BR MTR PSI
EVENTS
TIME.SEC


AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACL.G
TIME,SEC
AIRCRAFT: DC-9 (MARK IIIA)
RUNWAY: EDWARDS
RUN NO.: 75
SURFACE COND.:
DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 69010 LBS.
CG STA.: 582.1
HEADWIND VEL.:
0.00 KNOTS
AMB. TEMP.: 68.0 F
BAR. PRESS.:
27.73 IN. HG

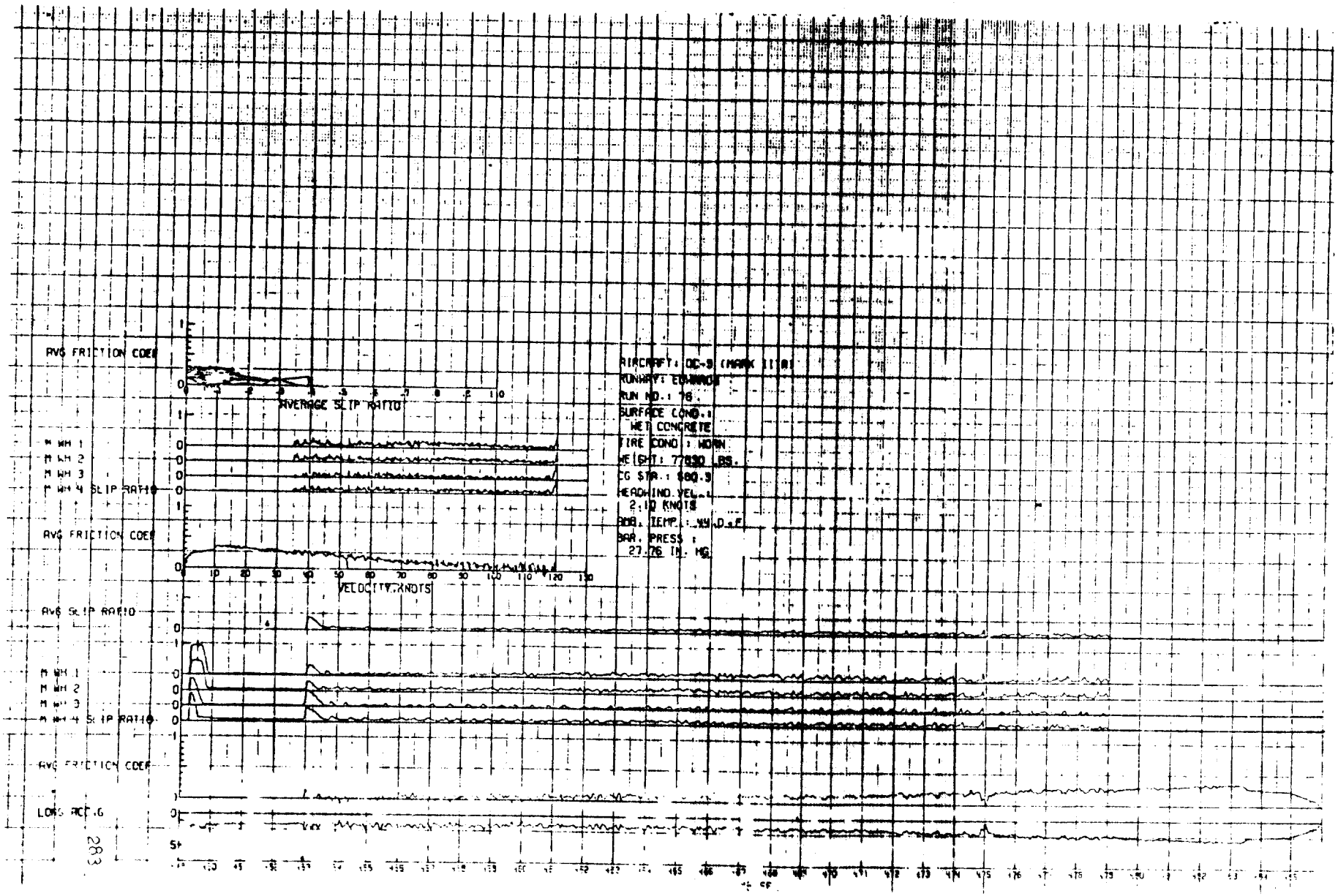

SPOILER
NORM ACC.G
LAT ACC.G
LONG ACC.G
TIME,SEC

4 OF 4

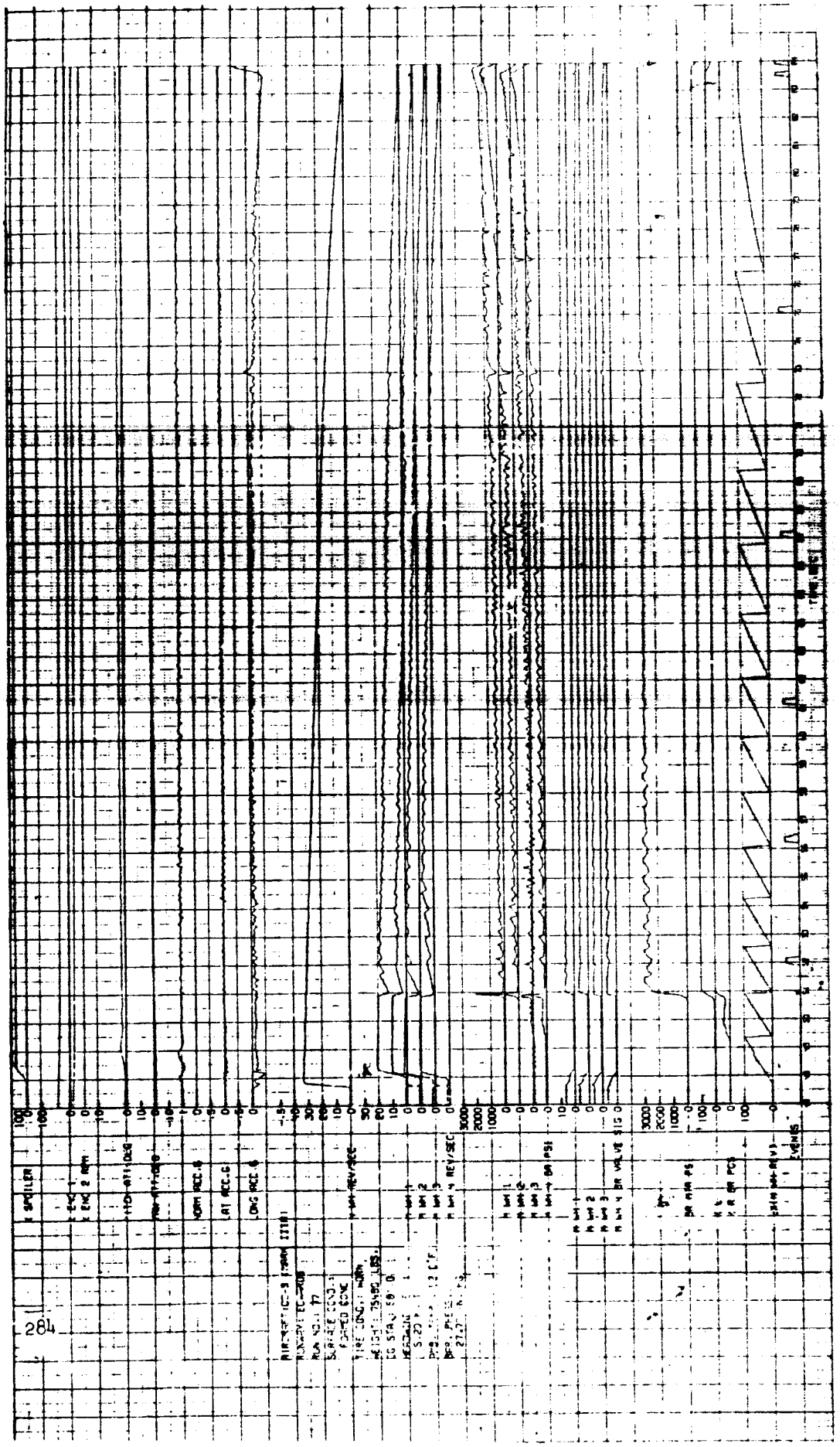
N77 27133 UNCLAS

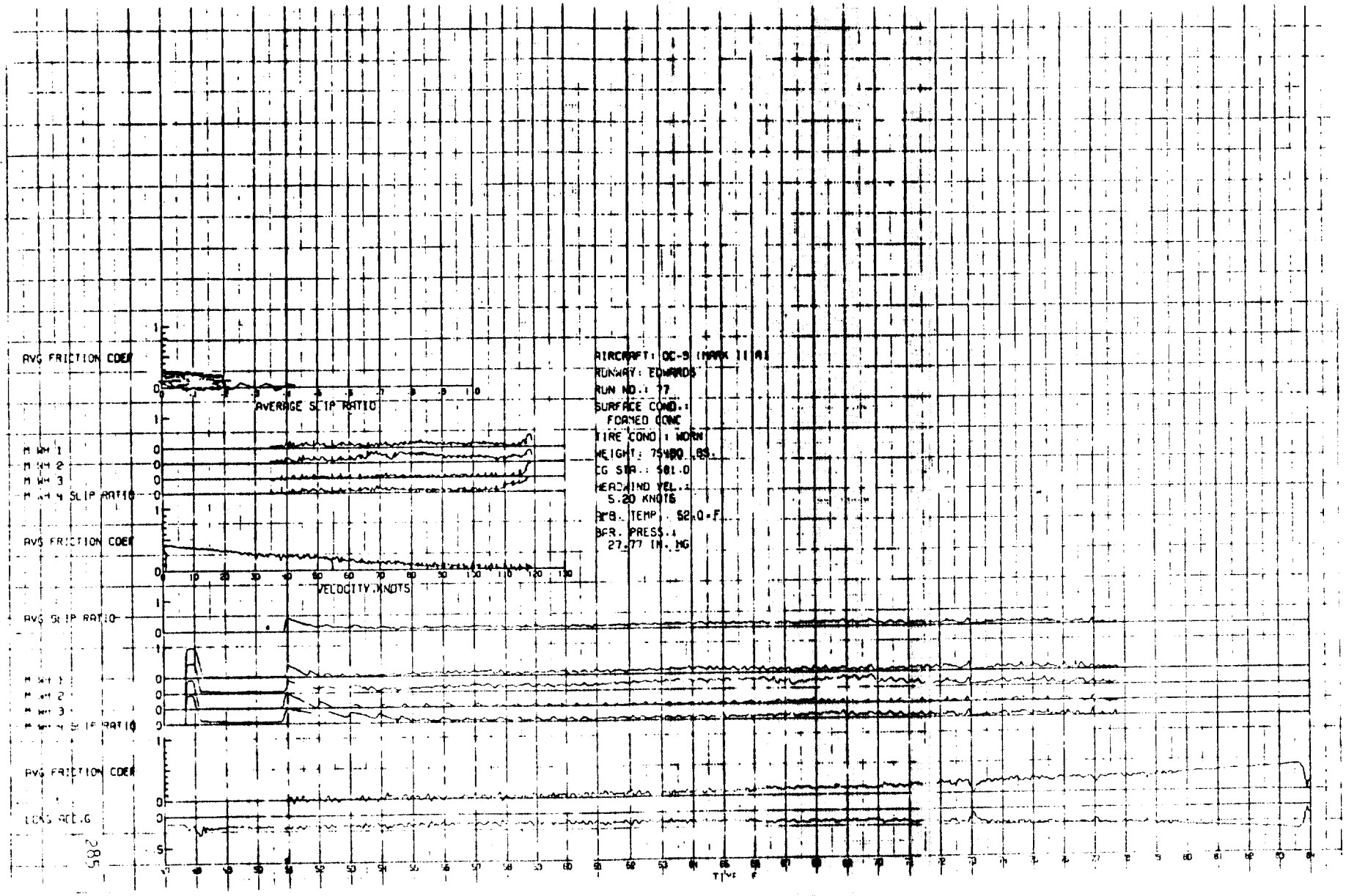


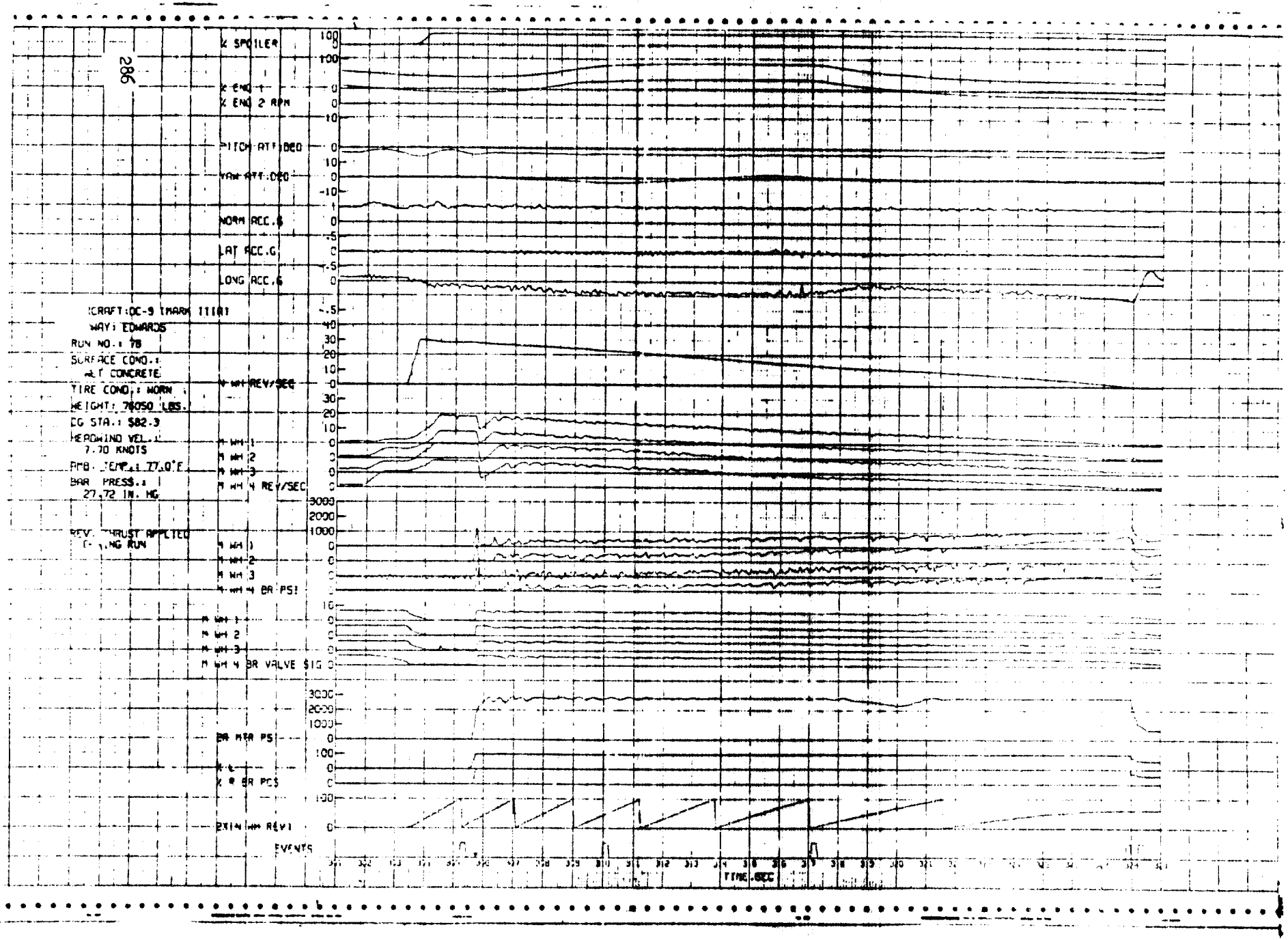
MICROCOPY RESOLUTION TEST CHART

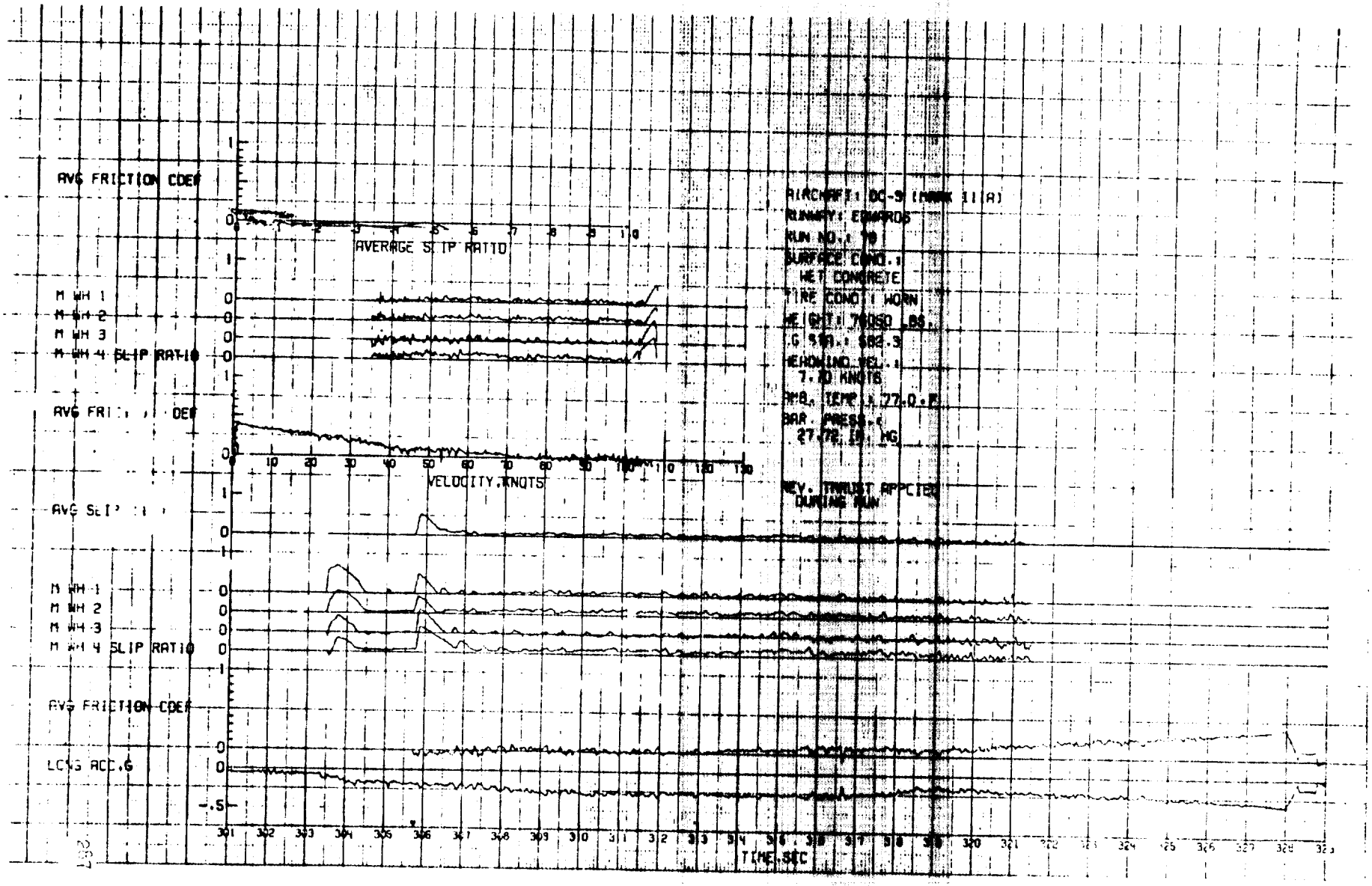

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY, KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
AIRCRAFT: DC-9 (MARK II-A)
RUNWAY: EDWARDS
RUN NO.: 16
SURFACE COND.:
WET CONCRETE
TIRE COND.: WORN
WEIGHT: 77830 LBS.
CG STA.: 880.9
HEADWIND VEL.:
2.10 KNOTS
AMB. TEMP.: 44.0 °F
BAR. PRESS.:
27.76 IN. HG

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

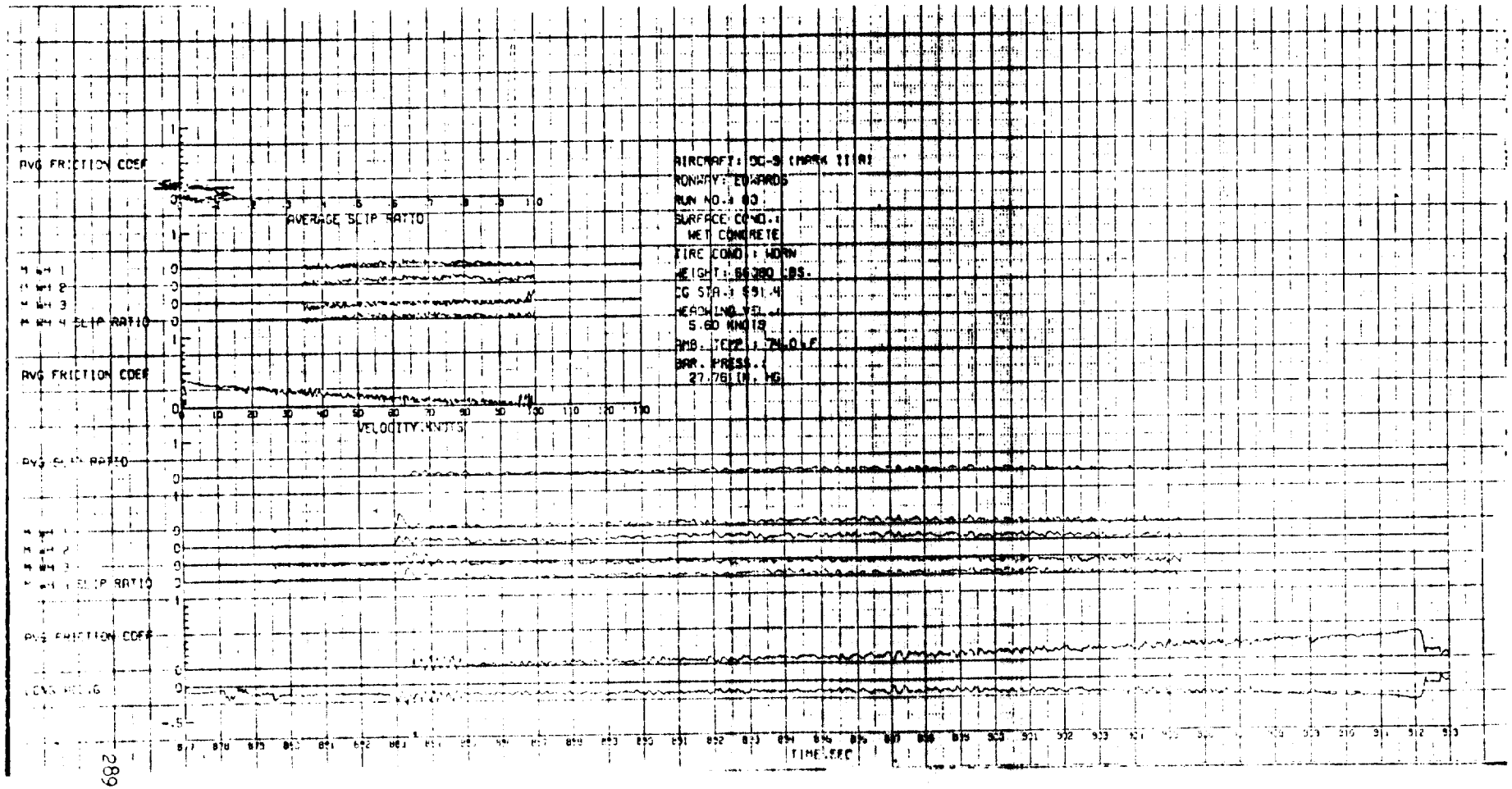


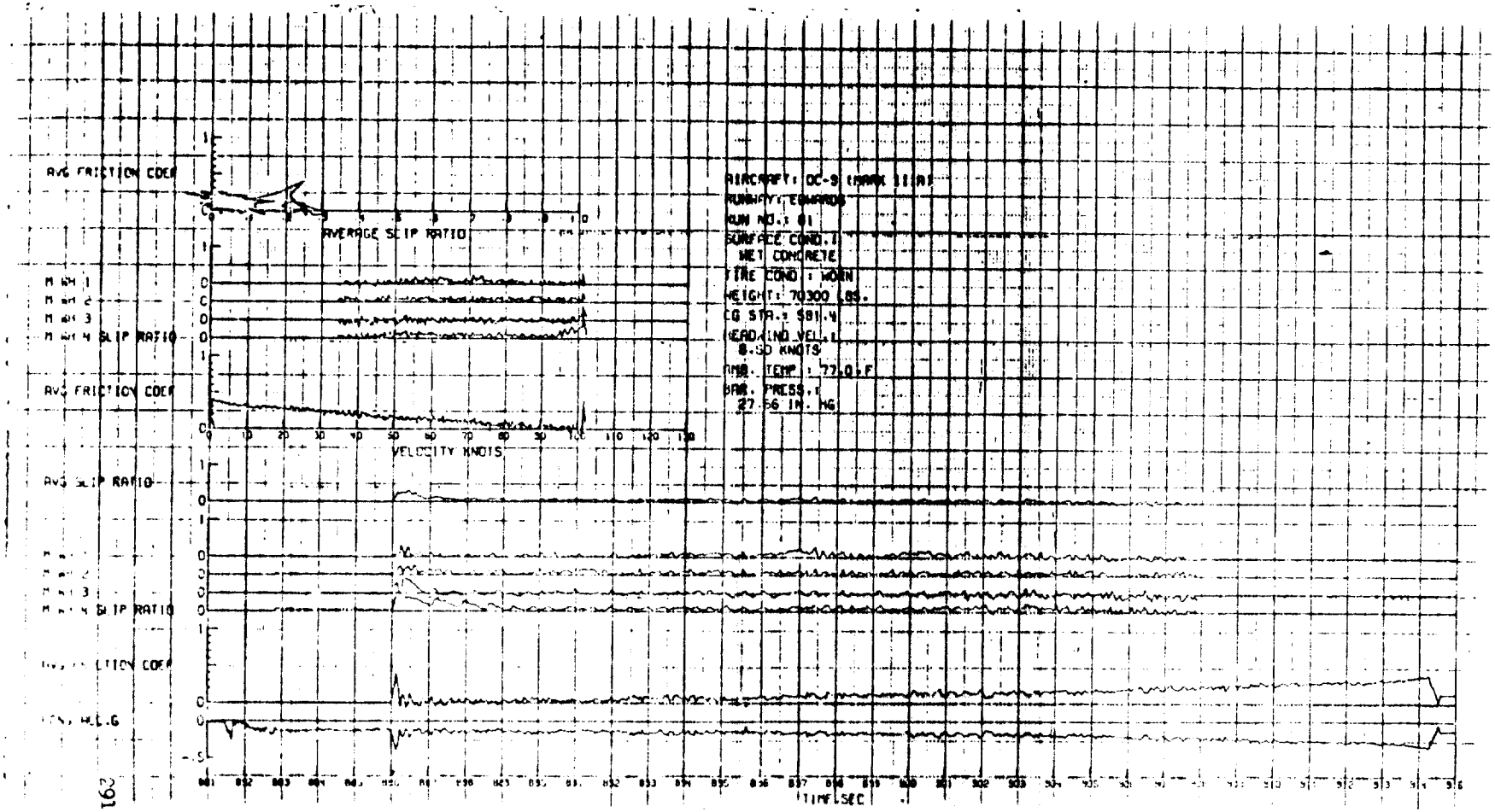

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME
AIRCRAFT: DC-9 (MARK II A)
RUNWAY: EDWARDS
RUN NO.: 77
SURFACE COND.:
FORMED CONC
TIRE COND.: WORN
WEIGHT: 75480 LBS.
CG STA.: 581.0
HEADWIND VEL.:
5.20 KNOTS
AMB. TEMP.: 52.0 F
BAR. PRESS.:
27.77 IN. HG

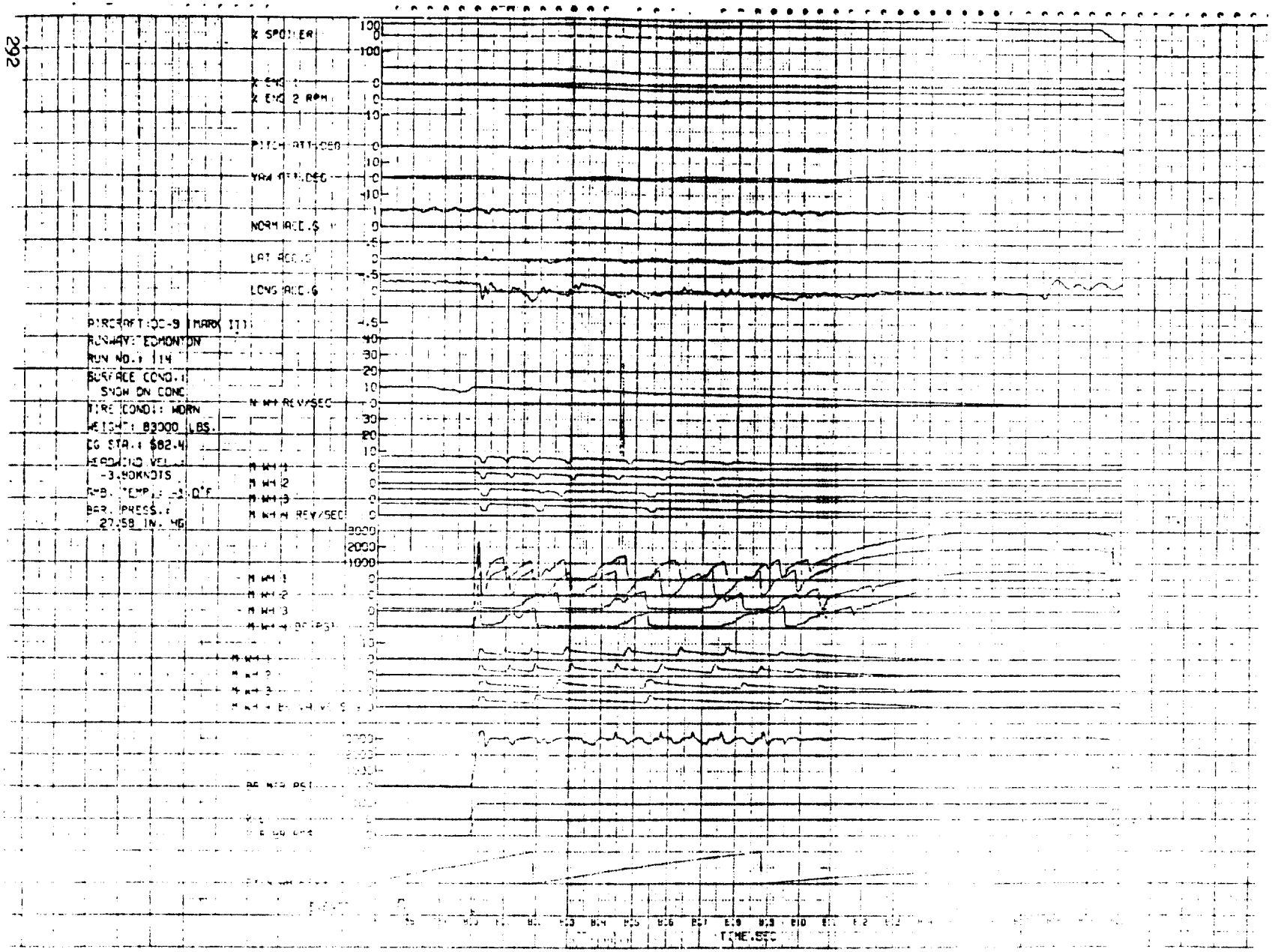

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
% NH REV/SEC
% NH 1
% NH 2
% NH 3
% NH 4 REV/SEC
% NH 1
% NH 2
% NH 3
% NH 4 BR PSI
% NH 1
% NH 2
% NH 3
% NH 4 BR VALVE SIG
BR MFR PSI
% BR PCS
EXIN NH REV
EVENTS
TIME.SEC
AIRCRAFT:DC-9 (MARK III&T
WAY: EDWARDS
RUN NO.: 78
SURFACE COND.:
DRY CONCRETE
TIRE COND.: WORN
WEIGHT: 76050 LBS.
CG STA.: 882.9
HEADWIND VEL.:
7.70 KNOTS
AMB. TEMP.: 77.0°F
BAR PRESS.:
27.72 IN. HG
REV. THRUST APPLIED
DURING RUN


AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC,G
TIME,SEC
RUNWAY: EDWARDS
RUN NO.: 19
SURFACE COND.:
WET CONCRETE
TIRE COND.: WORN
WEIGHT: 76050 LBS.
G.W.: 582.3
HEADWIND VEL.:
7.20 KNOTS
AMB. TEMP.: 77.0 F
BAR. PRESS.:
27.78 IN. HG
REV. THRUST APPLIED
DURING RUN

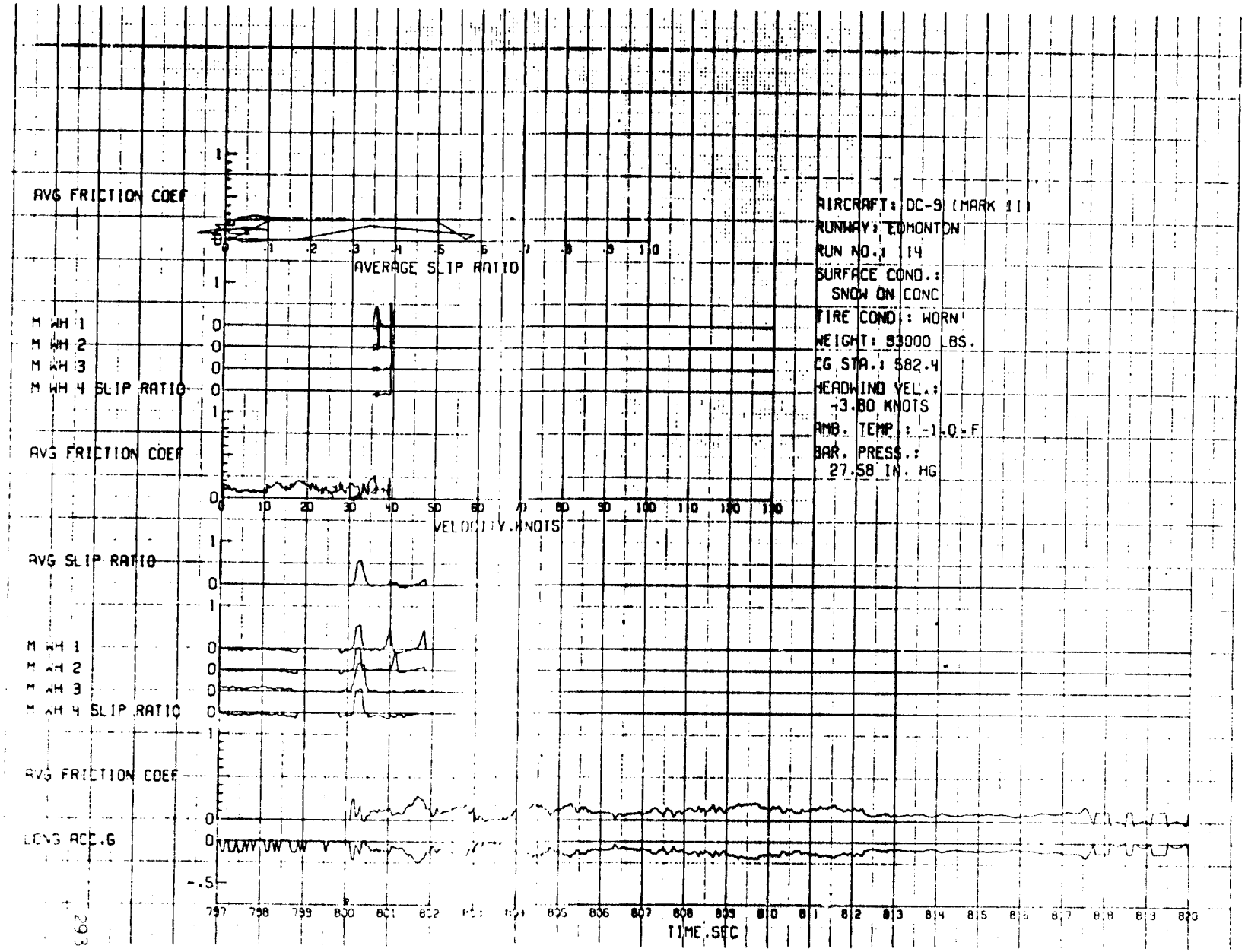
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ORIGINAL PAGE IS POOR

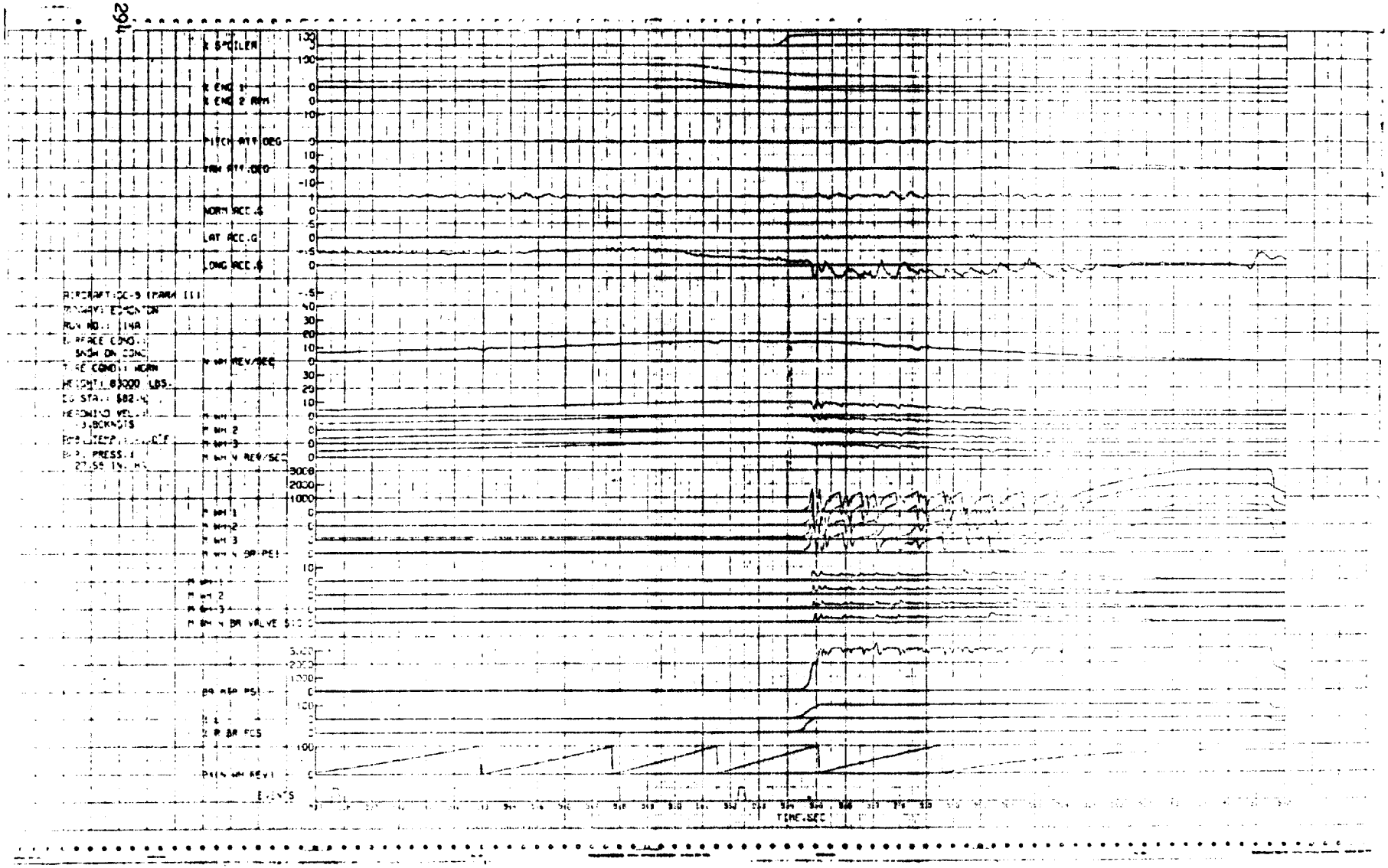

AVG FRICTION COEF
AVERAGE SLIP RATIO
WHEEL 1
WHEEL 2
WHEEL 3
WHEEL 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
WHEEL 1
WHEEL 2
WHEEL 3
WHEEL 4 SLIP RATIO
AVG FRICTION COEF
LONG ACCEL G
TIME,SEC
AIRCRAFT: DC-9 (MARK II A)
RUNWAY: EDWARDS
RUN NO.: 83
SURFACE COND.:
WET CONCRETE
TIRE COND.: WORN
WEIGHT: 86280 LBS.
CG STA.: 891.4
HEADWIND VEL.:
5.60 KNOTS
AMB. TEMP.: 74.0 F
BAR. PRESS.:
27.76 IN. HG

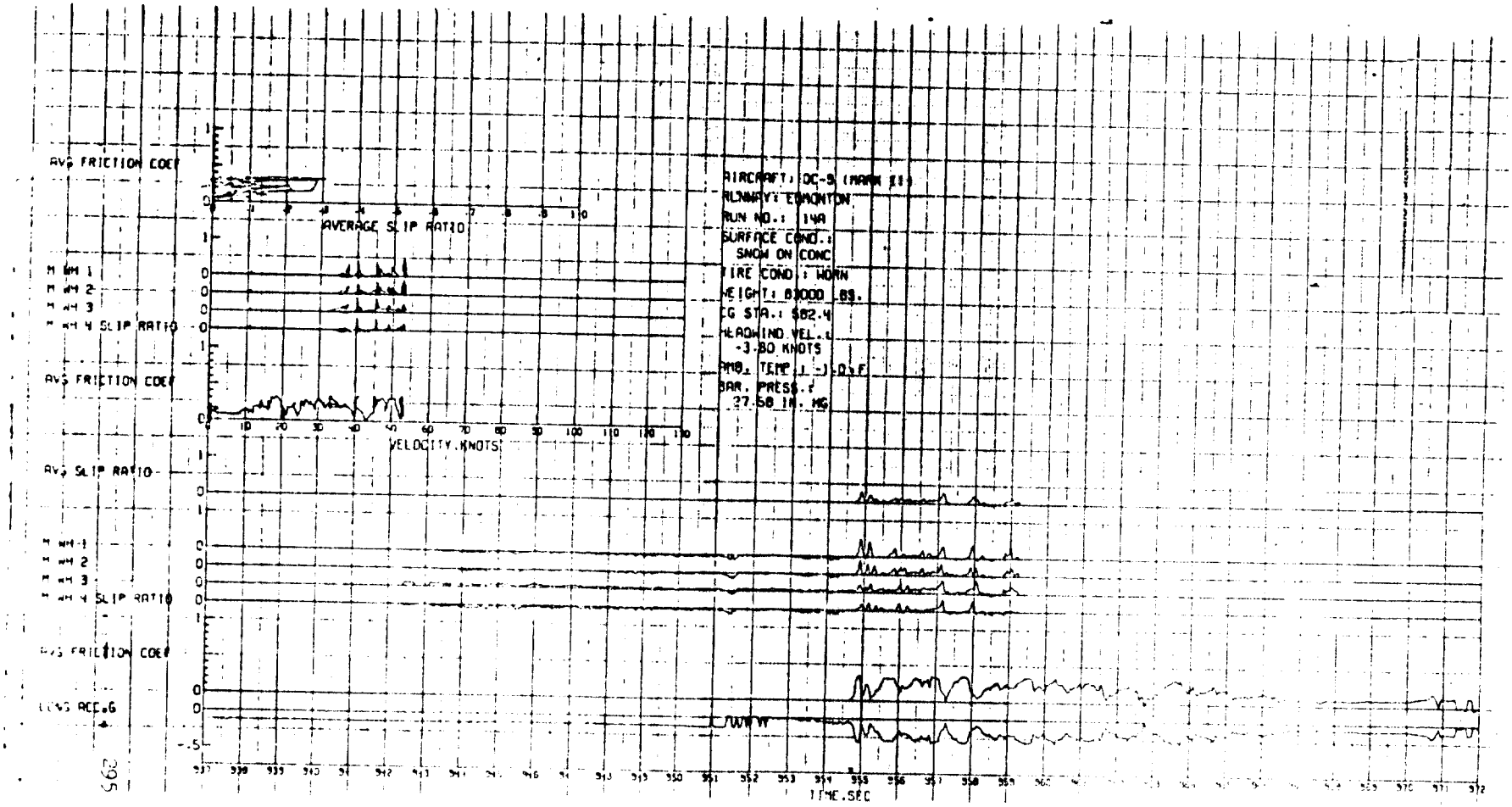

AVG FRICTION COEF
AVERAGE SLIP RATIO
VELOCITY KNOTS
AVG SLIP RATIO
TIME SEC
AIRCRAFT: DC-9
RUNWAY: EDWARDS
RUN NO.: 81
SURFACE COND.:
WET CONCRETE
TIRE COND.: WORN
WEIGHT: 70300 LBS.
CG STA.: 581.4
HEADWIND VEL.:
8.50 KNOTS
AMB. TEMP.: 77.0 F
BAR. PRESS.:
27.56 IN. HG



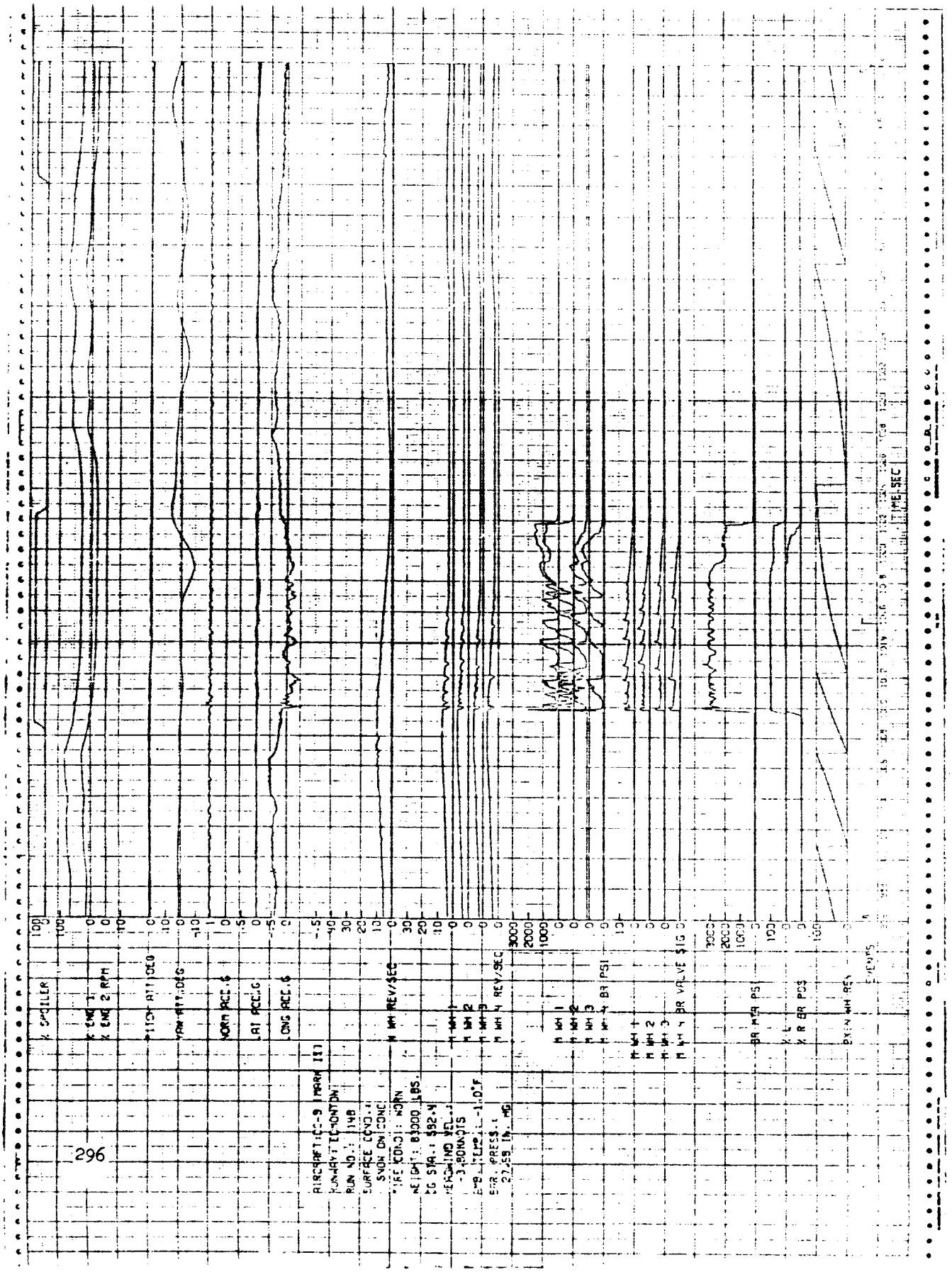
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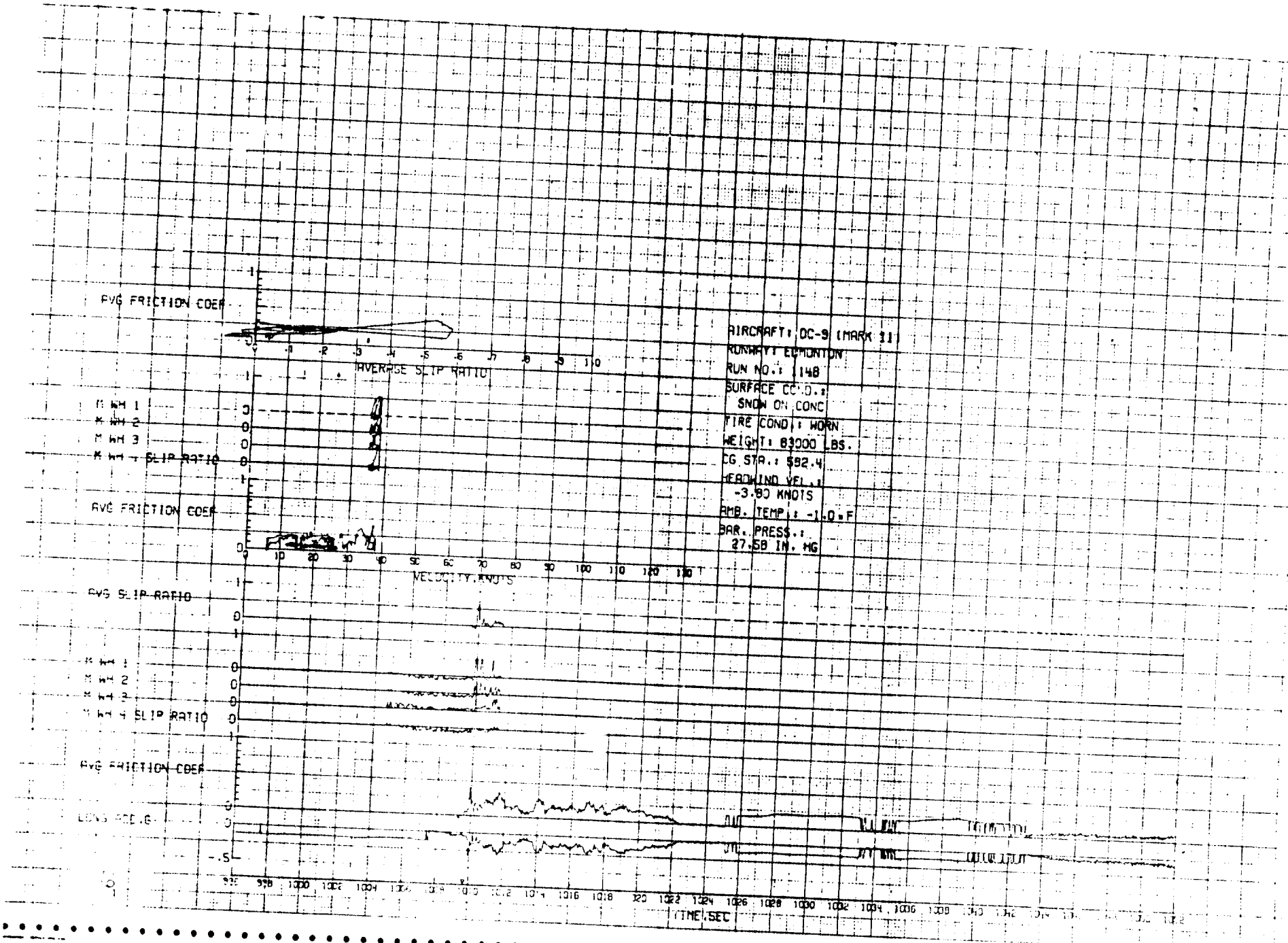

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: EDMONTON
RUN NO.: 14
SURFACE COND.:
SNOW ON CONC
TIRE COND.: WORN
WEIGHT: 83000 LBS.
CG STA.: 582.4
HEADWIND VEL.:
-3.80 KNOTS
AMB. TEMP.: -1.0 F
BAR. PRESS.:
27.58 IN. HG

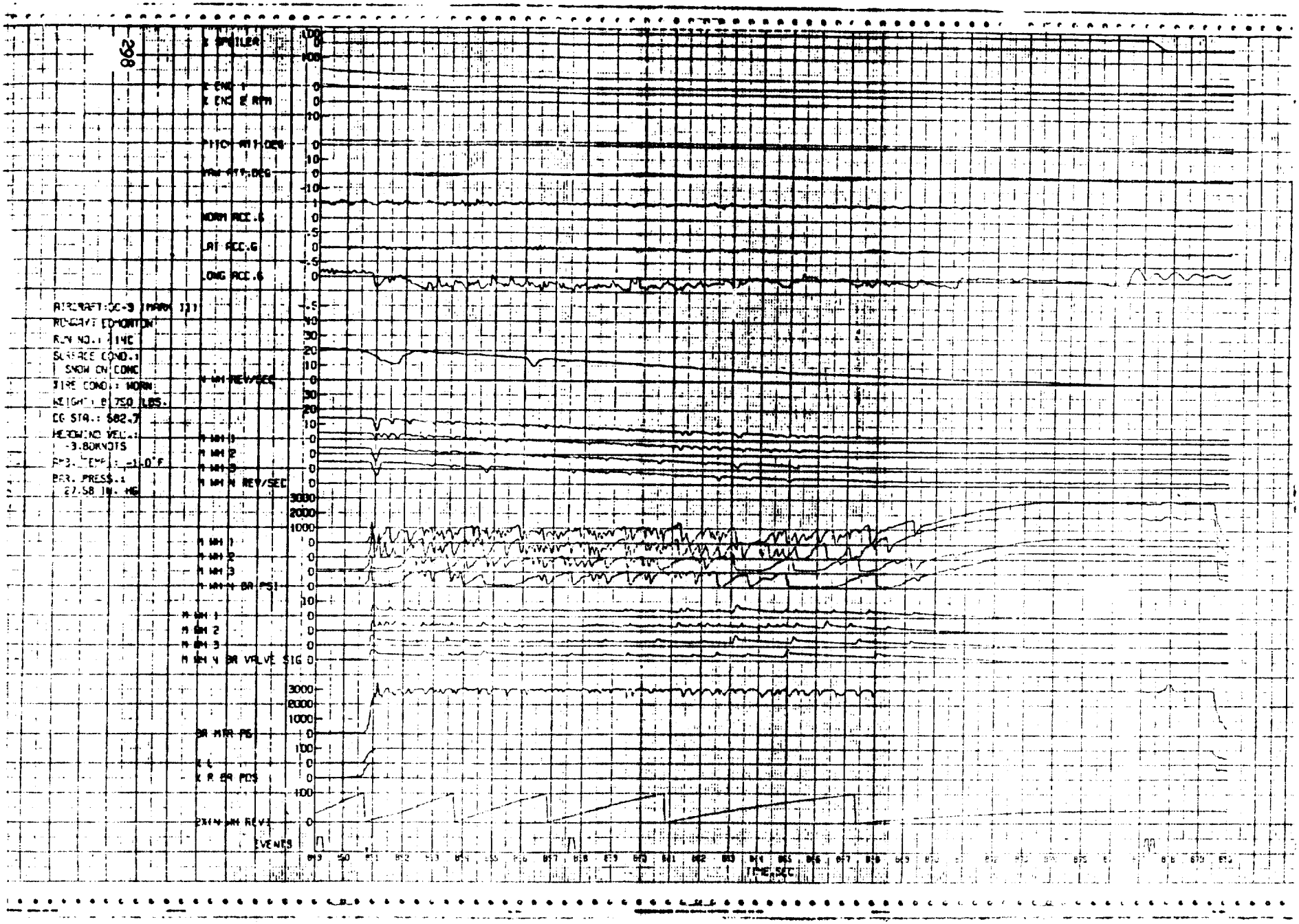

% SPOILER
% END 1
% END 2 RPM
PITCH RTE DEG
YAW RTE DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT: CC-9 (PARA II)
MANEUVER DESCRIPTION
RUN NO.: 14A
SMOKE ON CONC
TEST CONDITION: NORM
WEIGHT: 83000 LBS
C.G. STA.: 882.4
PRESS.:
27.55 IN. HG
R RPM REV/SEC
P RPM 1
P RPM 2
P RPM 3
P RPM 1
P RPM 2
P RPM 3
P RPM 1 SPOILER VALVE
PR RAM PSI
% P BR PCS
EVENTS
TIME,SEC

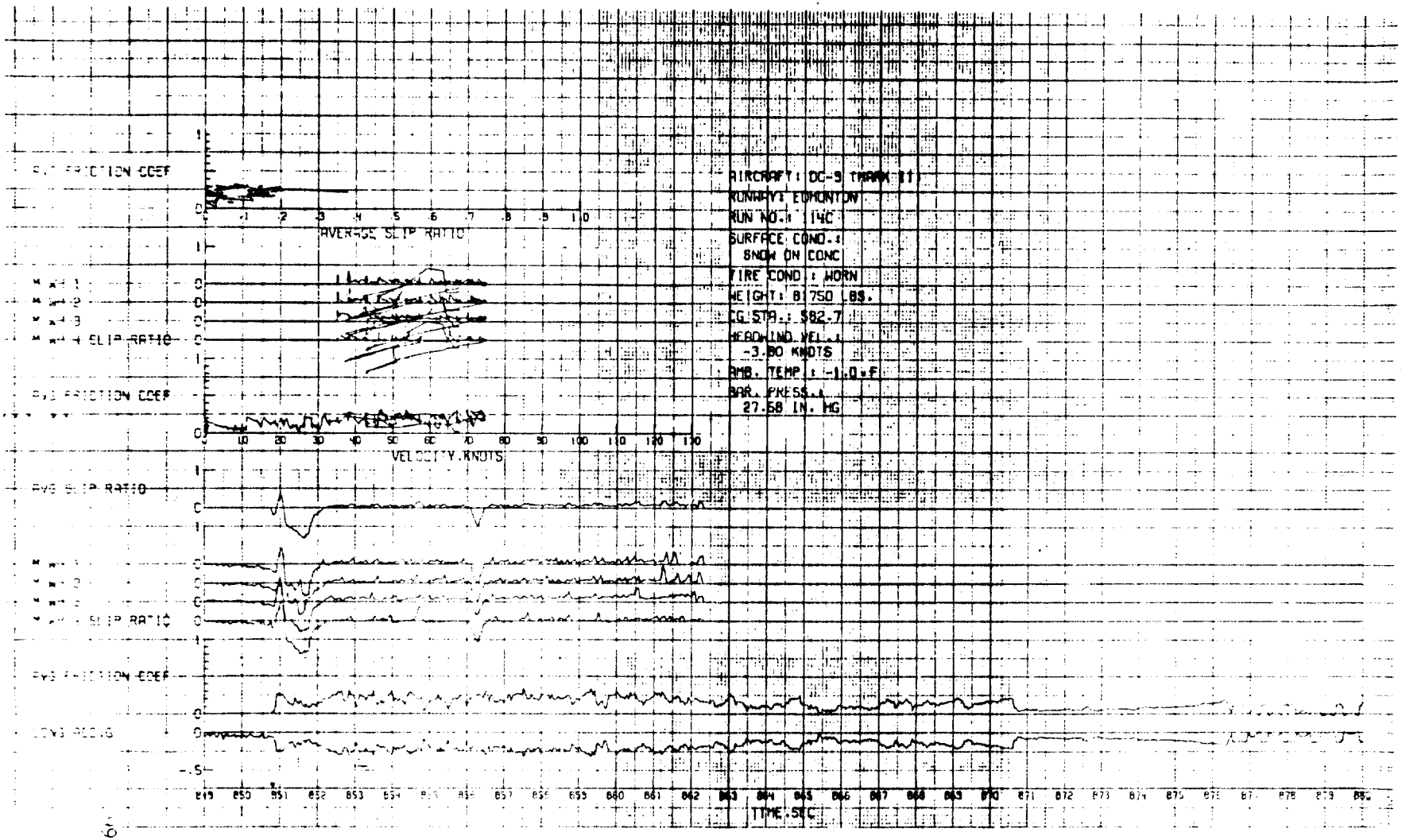

AVG FRICTION COEF
AVERAGE SLIP RATIO
AIRCRAFT: DC-9 (MARK II)
RUNWAY: EDMONTON
RUN NO.: 14A
SURFACE COND.:
SNOW ON CONC
TIRE COND.: WORN
WEIGHT: 83000 LBS.
CG STA.: 882.4
HEADWIND VEL.:
-3.80 KNOTS
AMB. TEMP.: -)-0.3 F
BAR. PRESS.:
27.58 IN. HG
VELOCITY, KNOTS
AVG SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC

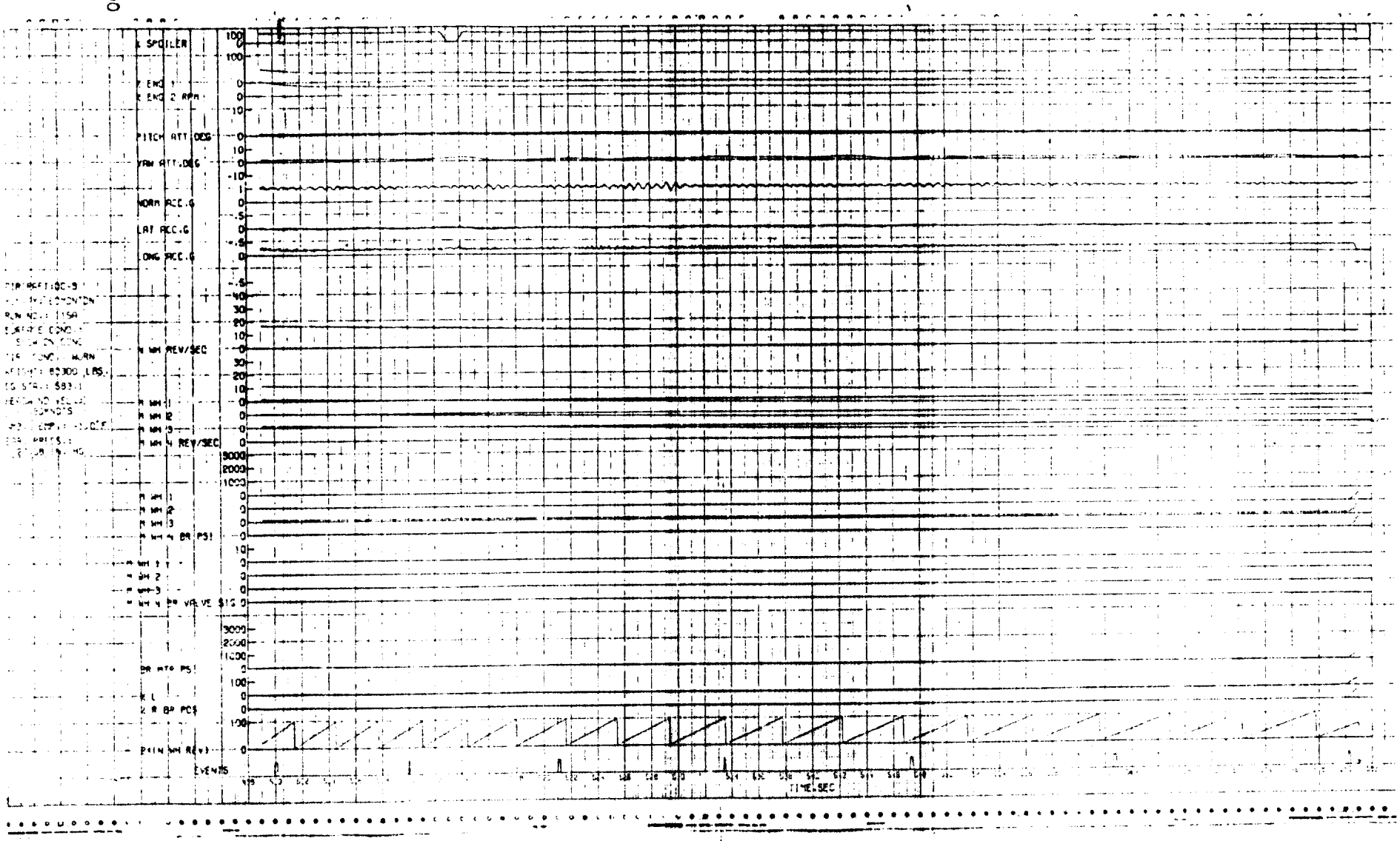
REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR




AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY, KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME,SEC
AIRCRAFT: DC-9 (MARK 31)
RUNWAY: EDMONTON
RUN NO.: 1148
SURFACE COND.:
SNOW ON CONC
TIRE COND.: WORN
WEIGHT: 83000 LBS.
CG STA.: 592.4
HEADWIND VEL.:
-3.80 KNOTS
AMB. TEMP.: -1.0 F
BAR. PRESS.:
27.58 IN. HG

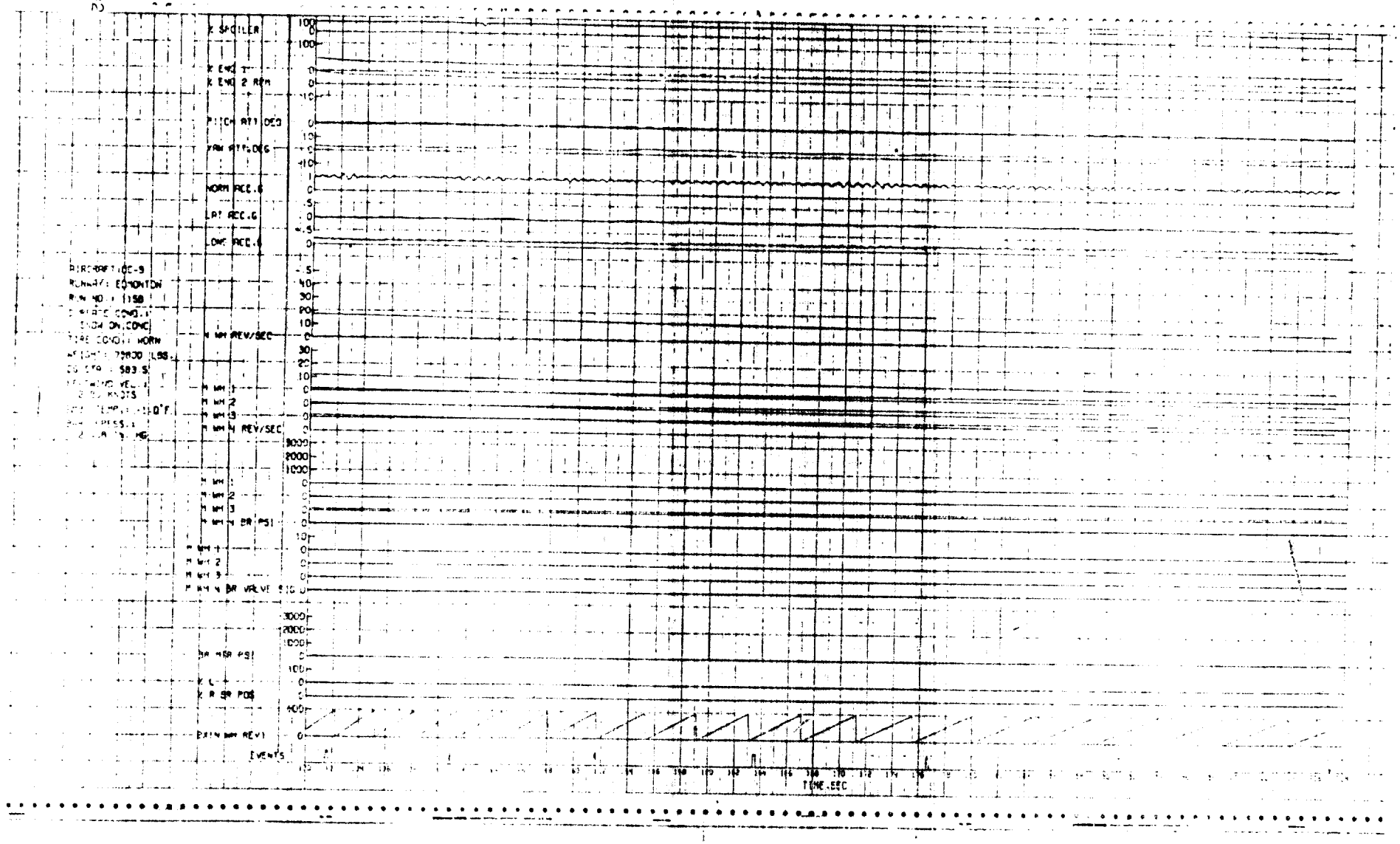

AIRCRAFT:DC-9 (MARK III)
RUNWAY:EDMONTON
RUN NO.: 14C
SURFACE COND.:
SNOW ON CONC
TIRE COND.: WORN
WEIGHT: 0 750 LBS.
CG STA.: 582.7
HEADWIND VEL.:
-3.8KNOTS
RWY. TEMP.: -1.0°F
BAR. PRESS.:
27.58 IN. HG
TIME,SEC


AVERAGE SLIP RATIO
VELOCITY, KNOTS
TIME, SEC
AIRCRAFT: DC-9 TRAWK II
RUNWAY: EDMONTON
RUN NO.: 14C
SURFACE COND.:
SNOW ON CONC
TIRE COND.: WORN
WEIGHT: 81750 LBS.
CG STA.: 582.7
HEADWIND VEL.:
-3.80 KNOTS
AMB. TEMP.: -1.0°F
BAR. PRESS.:
27.58 IN. HG

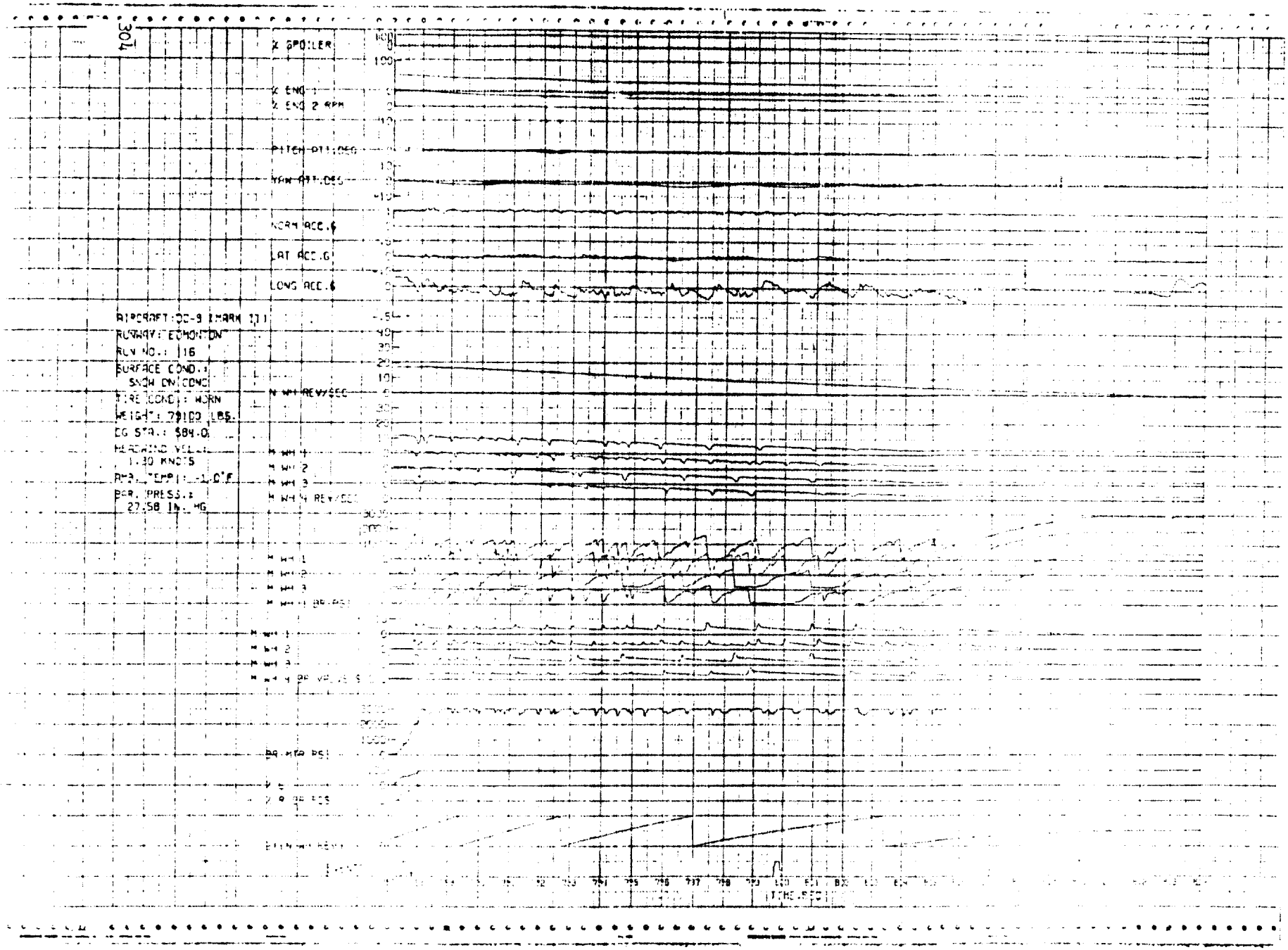

L SPOILER
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
EVENTS
TIME-SEC

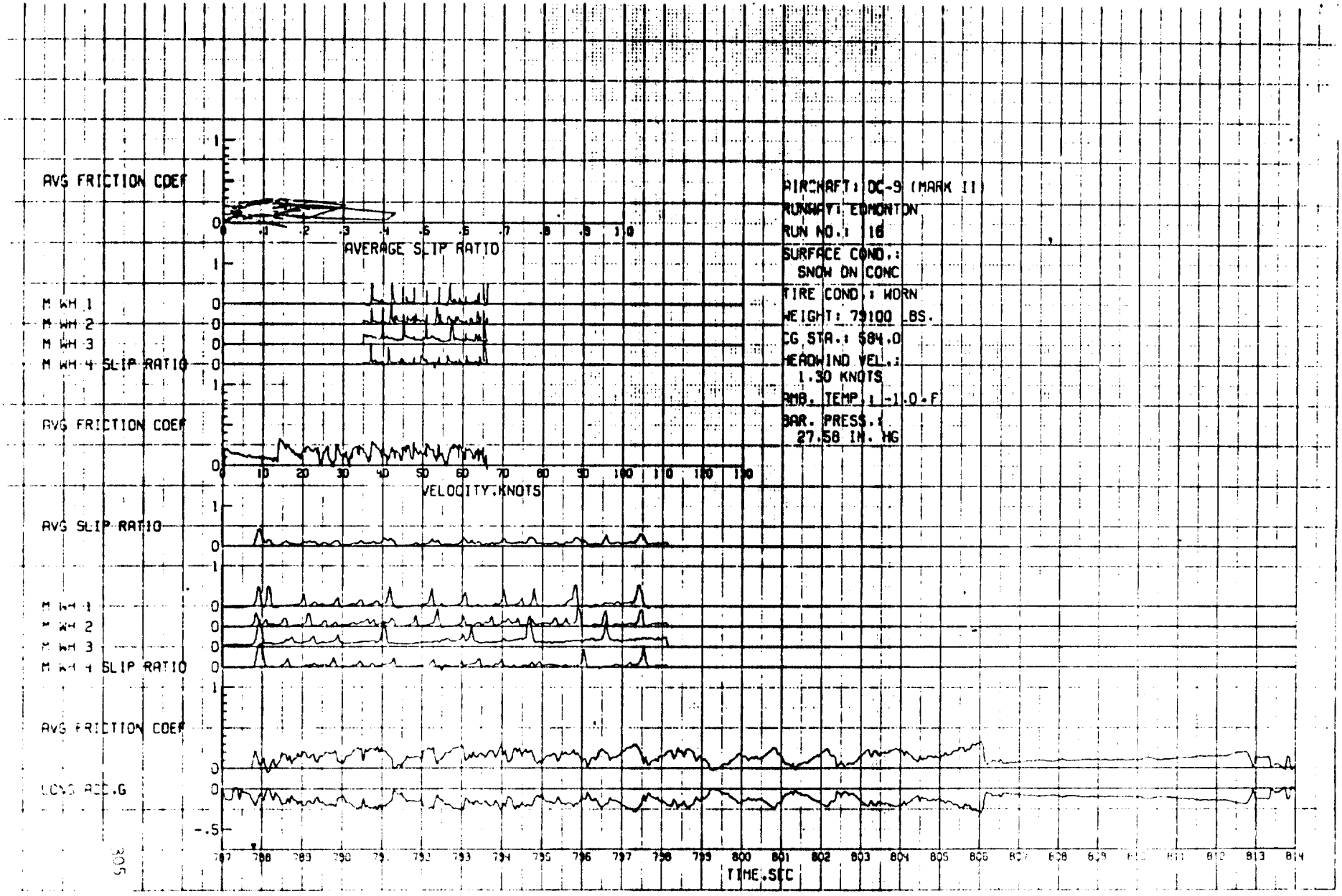
NOT APPLICABLE

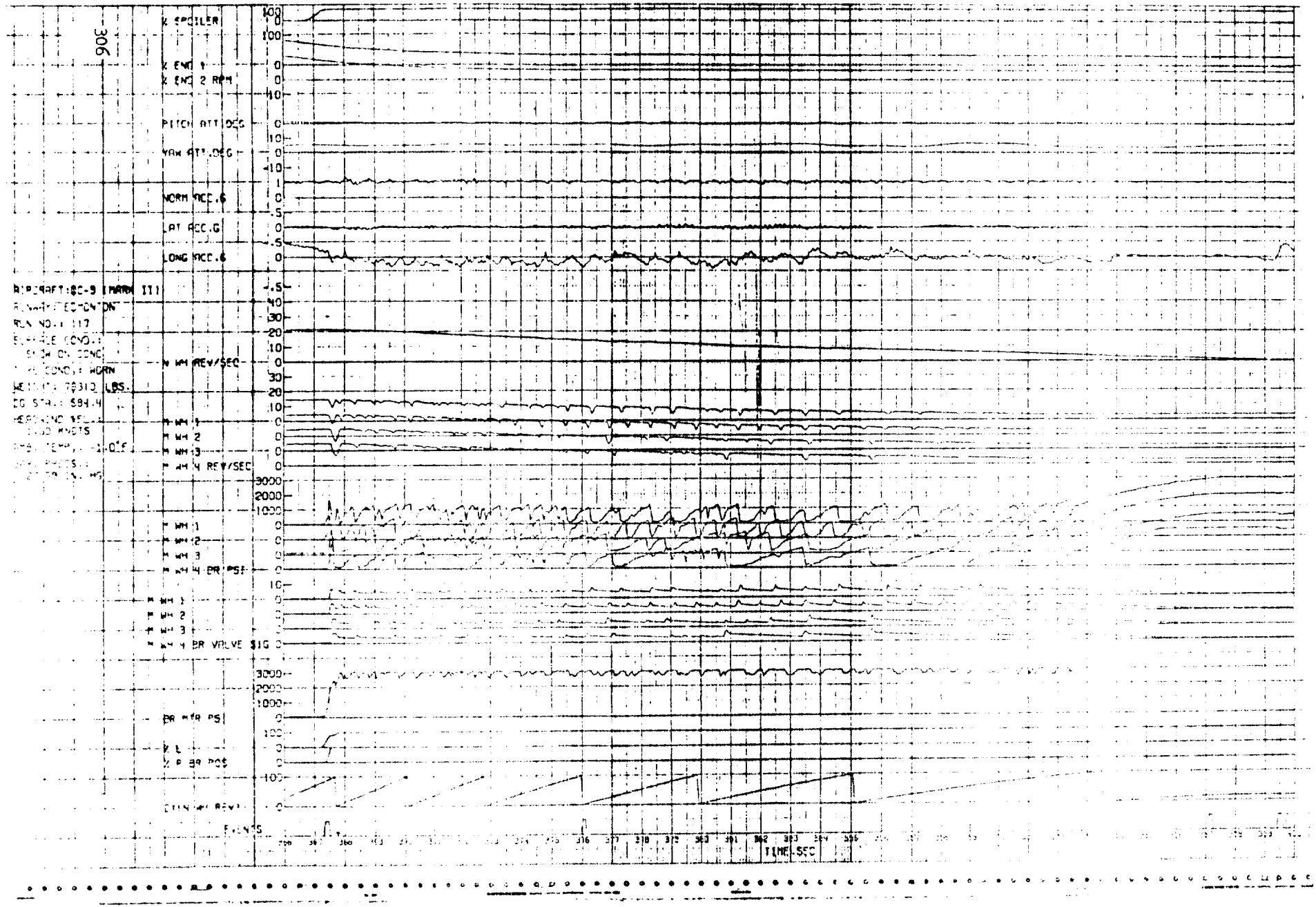
(No braking during run)

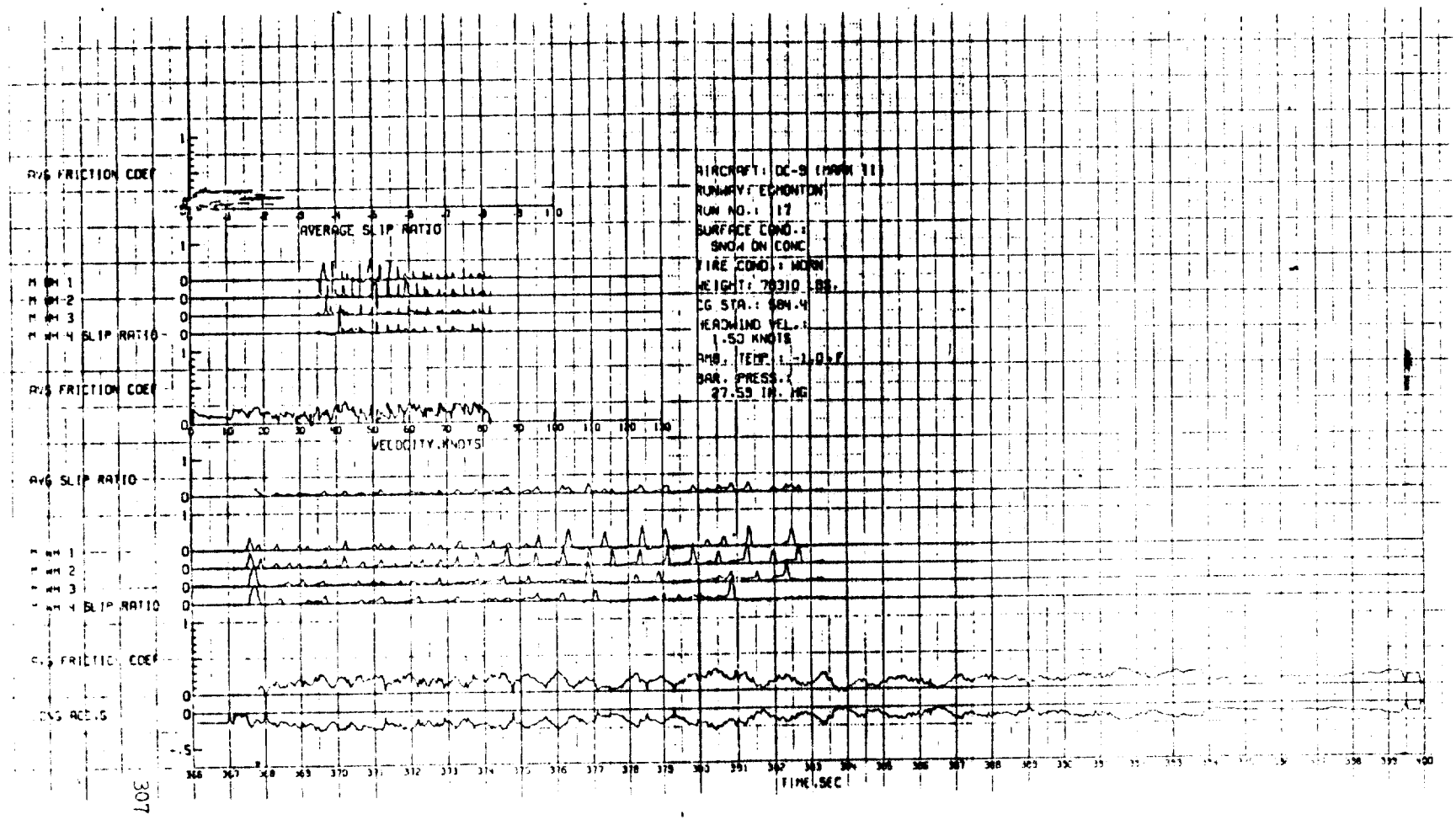

% SPOILER
% ENG 1
% ENG 2 REV
PITCH ATT DEG
YAW ATT DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9
RUNWAY: EDMONTON
N1 REV/SEC
N1 1
N1 2
N1 3
N1 4 REV/SEC
N1 1
N1 2
N1 3
N1 4 BR PSI
N1 1
N1 2
N1 3
N1 4 BR VALVE
BR PSI
% L BR POS
% R BR POS
EVENTS
TIME.SEC

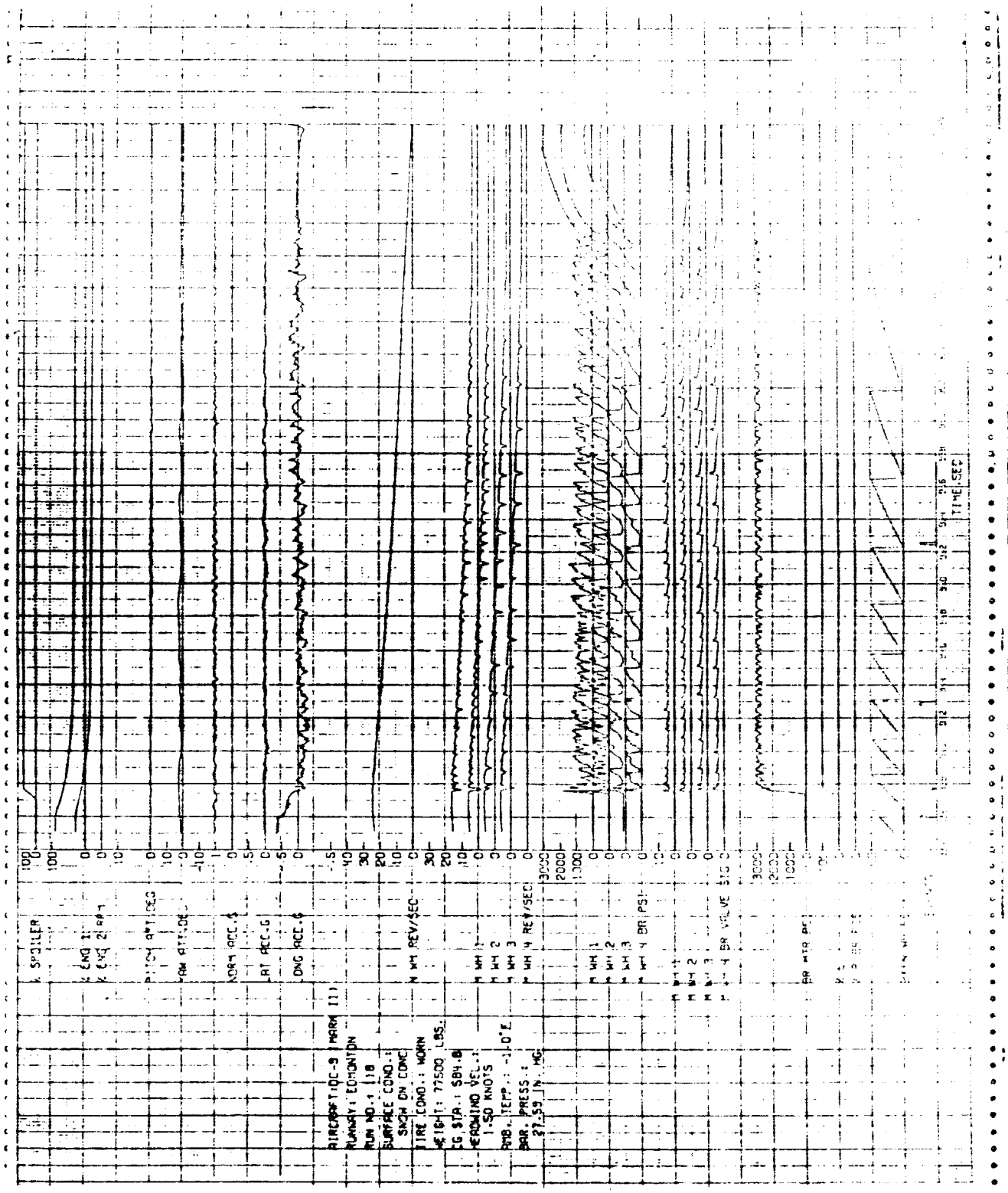
NOT APPLICABLE
(No braking during run)

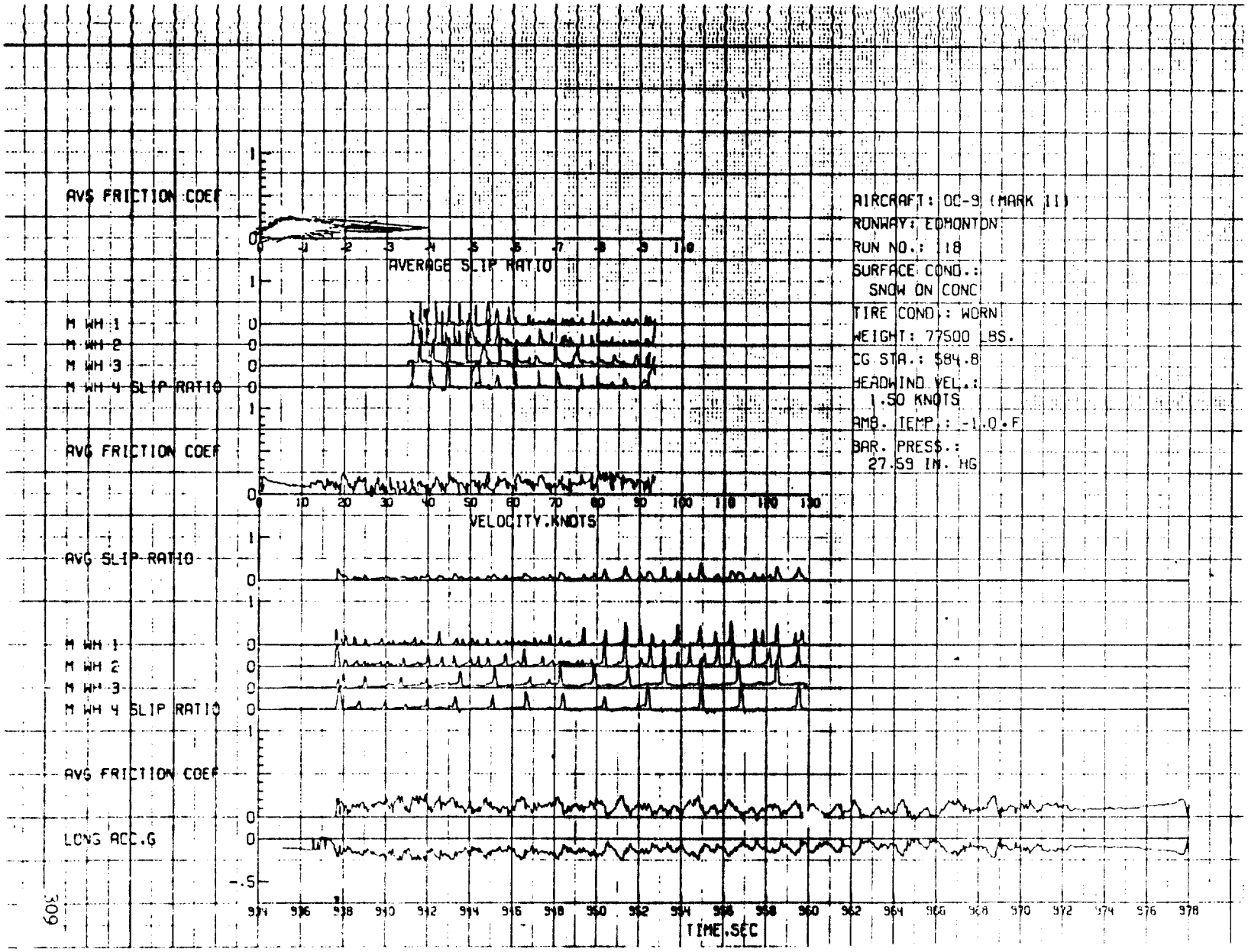

304
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH RT.DEG
YAW RT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (MARK 1)
RUNWAY: EDMONTON
RUN NO.: 16
SURFACE COND.:
SNOW ON CONC
FIRE COND.: NORM
WEIGHT: 79100 LBS.
CG STA.: 884.0
HEADWIND VEL.:
130 KNOTS
AMB. TEMP.: -1.0°F
BAR. PRESS.:
27.58 IN. HG
WH 1 REV/SEC
WH 2
WH 3
WH 4 REV/SEC
BRAKE PSI
TIME SEC


AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: EDMONTON
RUN NO.: 16
SURFACE COND.:
SNOW ON CONC
TIRE COND.: WORN
WEIGHT: 79100 LBS.
CG STA.: 584.0
HEADWIND VEL.:
1.30 KNOTS
AMB. TEMP.: -1.0 F
BAR. PRESS.:
27.58 IN. HG

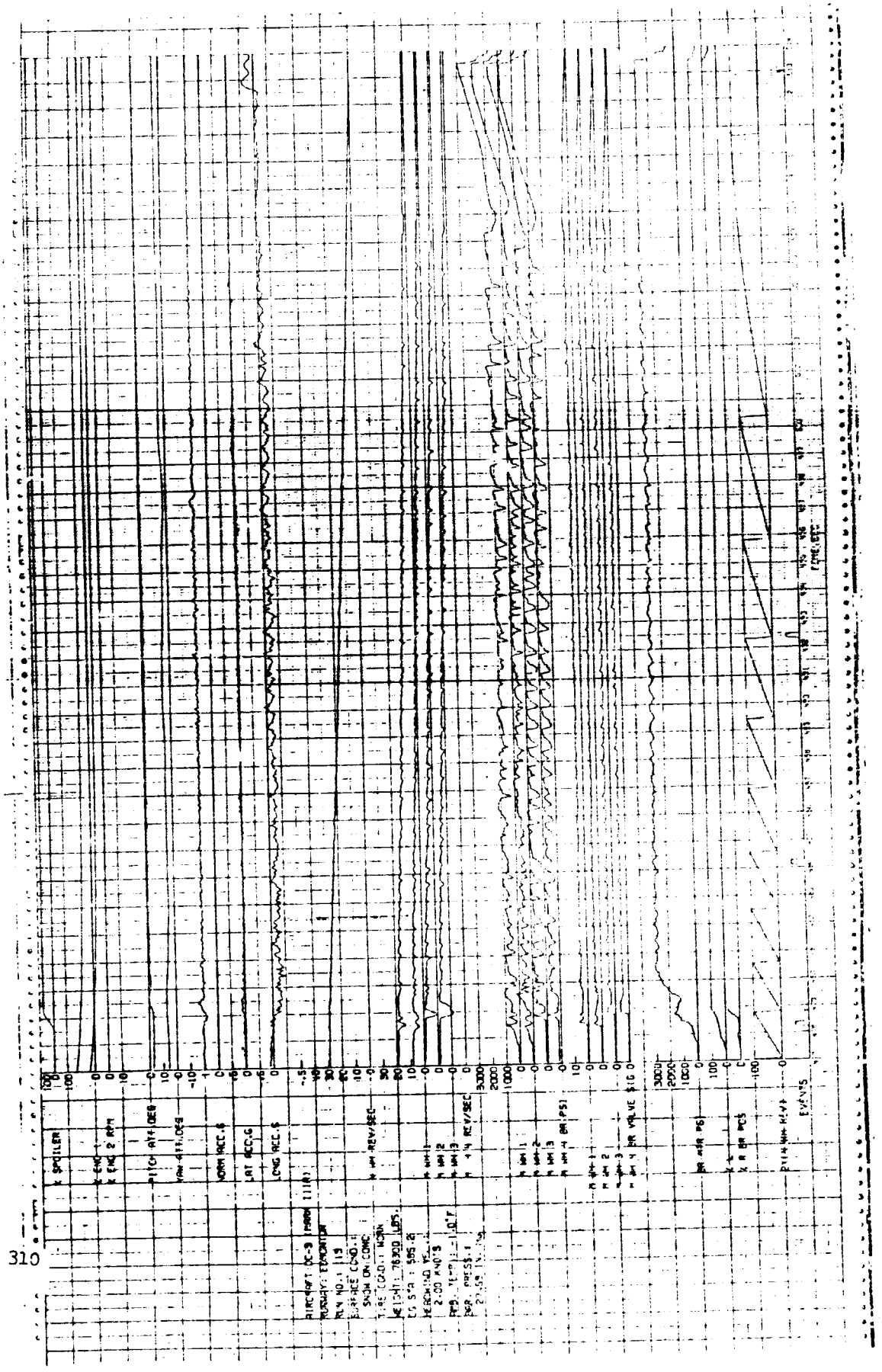

306
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:BC-9 (MARK II)
RUN NO.: 117
N1 RPM REV/SEC
N1 #1
N1 #2
N1 #3
N1 #4 REV/SEC
P1 #1
P1 #2
P1 #3
P1 #4 PR PSI
P1 #1
P1 #2
P1 #3
P1 #4 PR VALVE SIG
PR #1R PSI
% L
½ PR PCS
EVENTS
TIME SEC

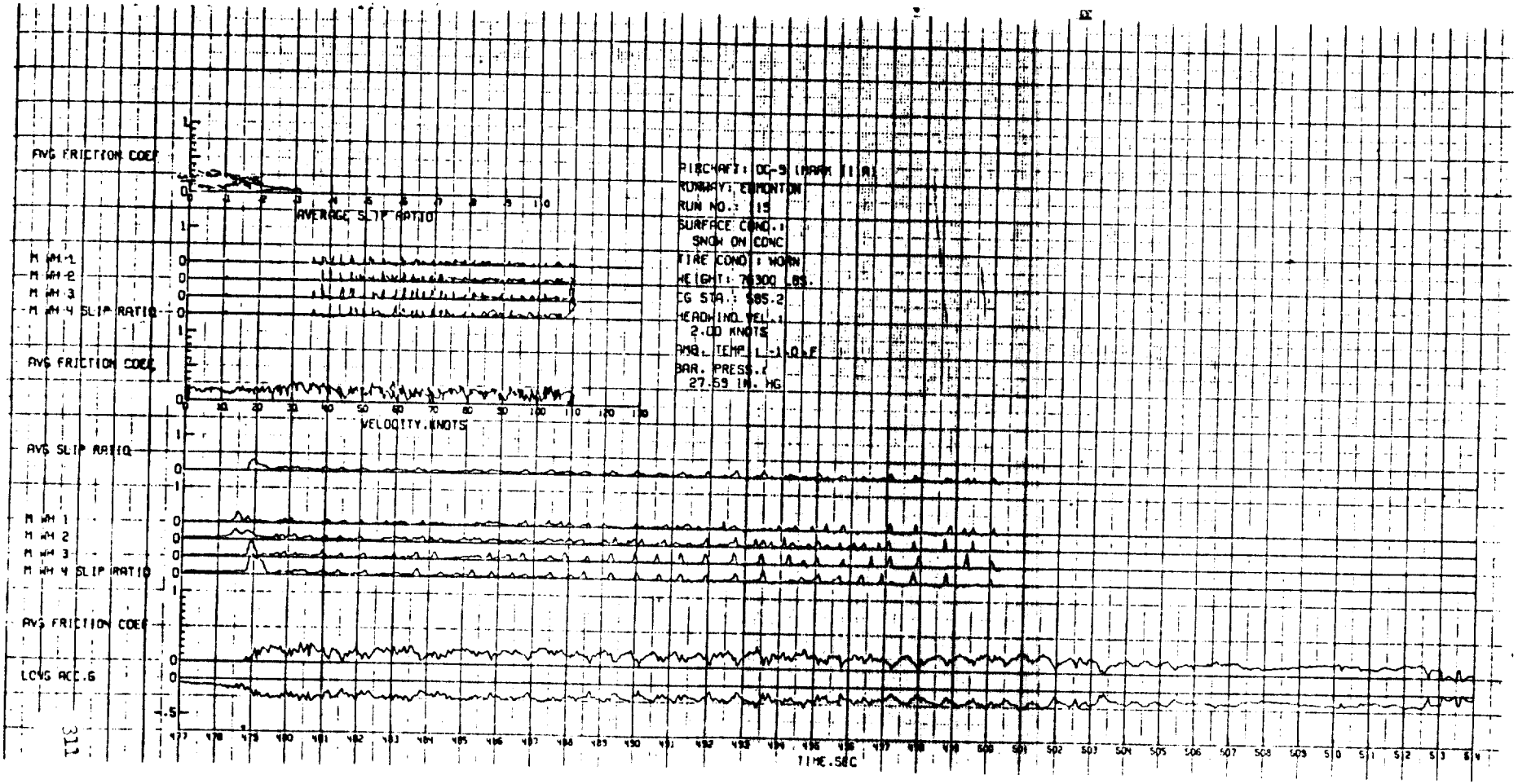

AVERAGE SLIP RATIO
AVG FRICTION COEF
WHEEL 1
WHEEL 2
WHEEL 3
WHEEL 4 SLIP RATIO
AVG FRICTION COEF
AVG SLIP RATIO
WHEEL 1
WHEEL 2
WHEEL 3
WHEEL 4 SLIP RATIO
AVG FRICTION COEF
CG ACC.G
VELOCITY,KNOTS
TIME,SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: EDMONTON
RUN NO.: 17
SURFACE COND.:
SNOW ON CONC
TIRE COND.: WORN
WEIGHT: 70310 LBS.
CG STA.: 684.4
HEADWIND VEL.:
1.50 KNOTS
AMB. TEMP.: -10.0 F
BAR. PRESS.:
27.59 IN. HG

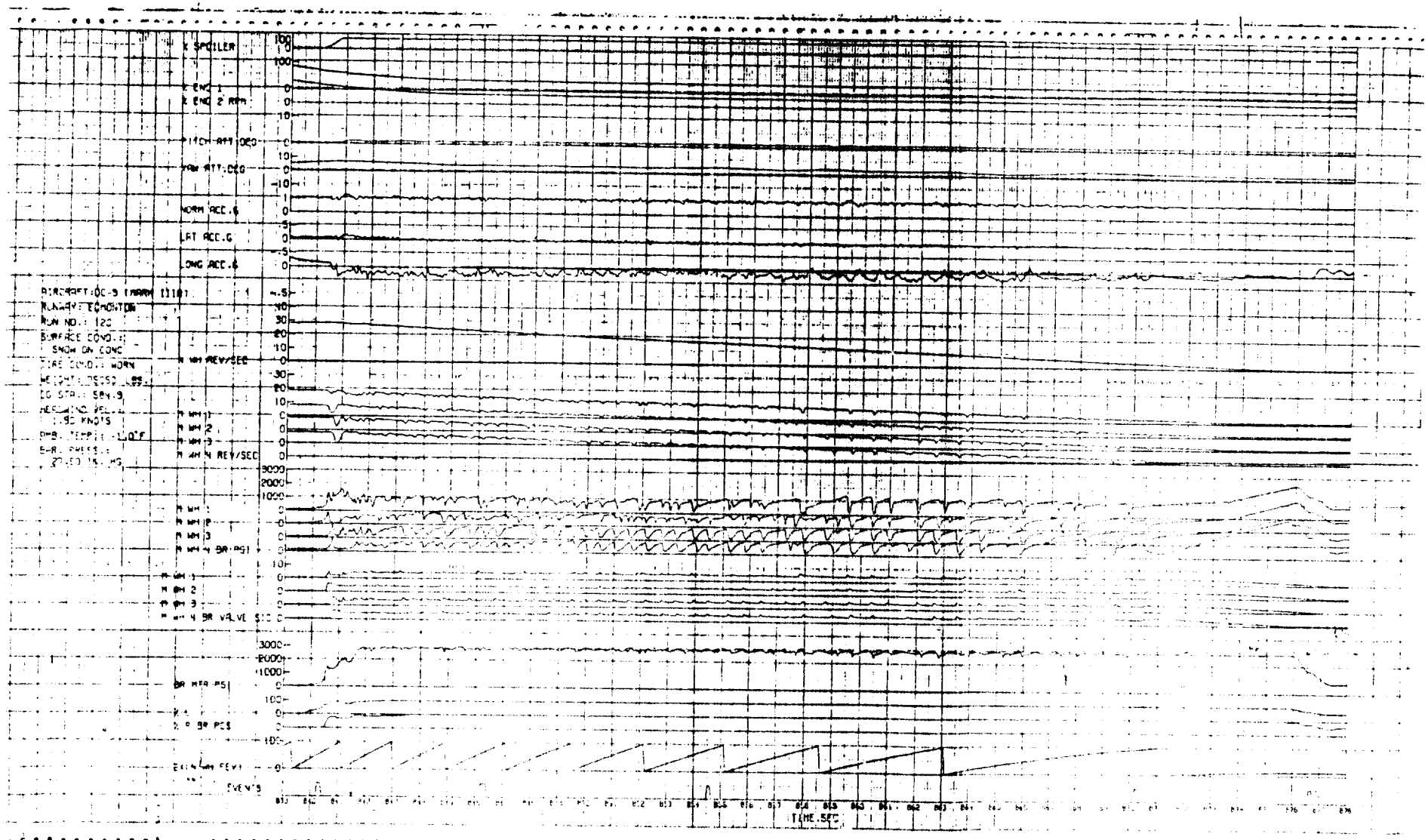

SPOILER
PITCH ATTITUDE
NORM ACC.G
LAT ACC.G
DWG ACC.G
AIRCRAFT:DC-9 MARK III
RUNWAY: EDMONTON
RUN NO.: 18
SURFACE COND.: SNOW ON CONC
TIRE COND.: WORN
WEIGHT: 77500 LBS.
CG STA.: 584.8
HEADWIND VEL.: 1.50 KNOTS
AMB. TEMP.: -1.0°F
BAR. PRESS.: 27.59 IN. HG
WH 1 REV/SEC
WH 2
WH 3
WH 4 REV/SEC
WH 1
WH 2
WH 3
WH 4 BR PSI
WH 1
WH 2
WH 3
WH 4 BR VALVE
BR MTR PSI
TIME(SEC)

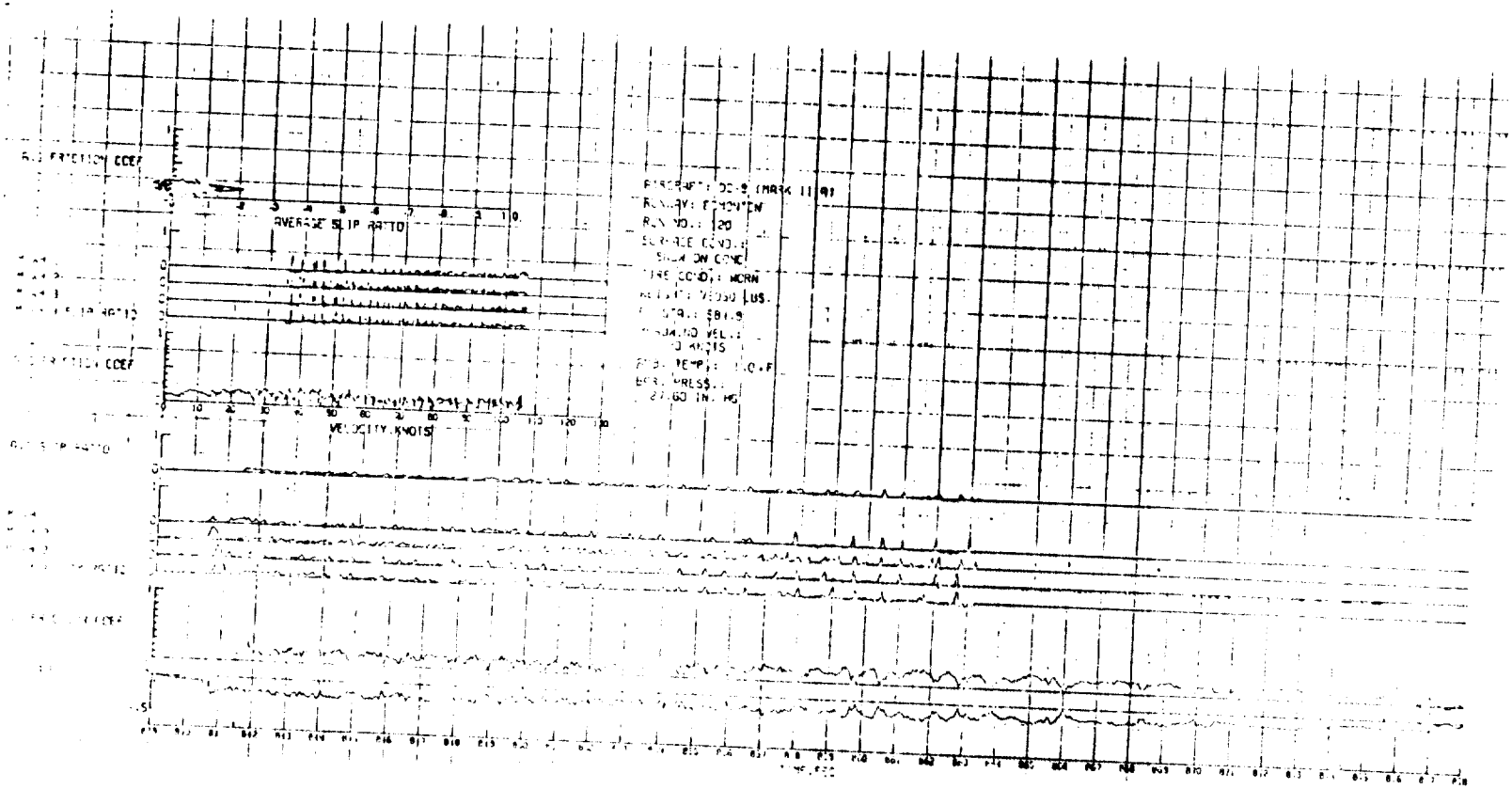

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: EDMONTON
RUN NO.: 18
SURFACE COND.:
SNOW ON CONC
TIRE COND.: WORN
WEIGHT: 77500 LBS.
CG STA.: 884.8
HEADWIND VEL.:
1.50 KNOTS
AMB. TEMP.: -1.0 F
BAR. PRESS.:
27.59 IN. HG

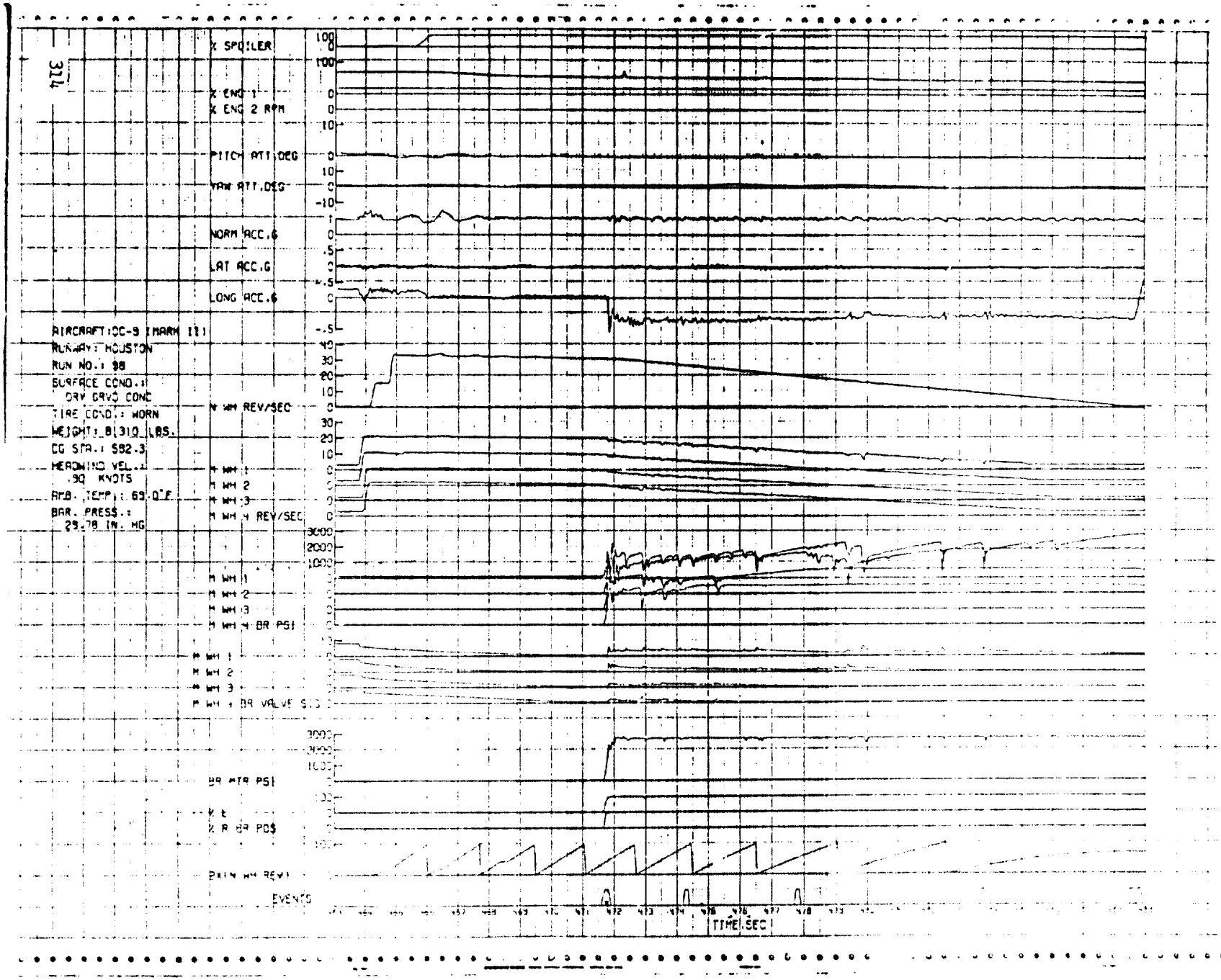
REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

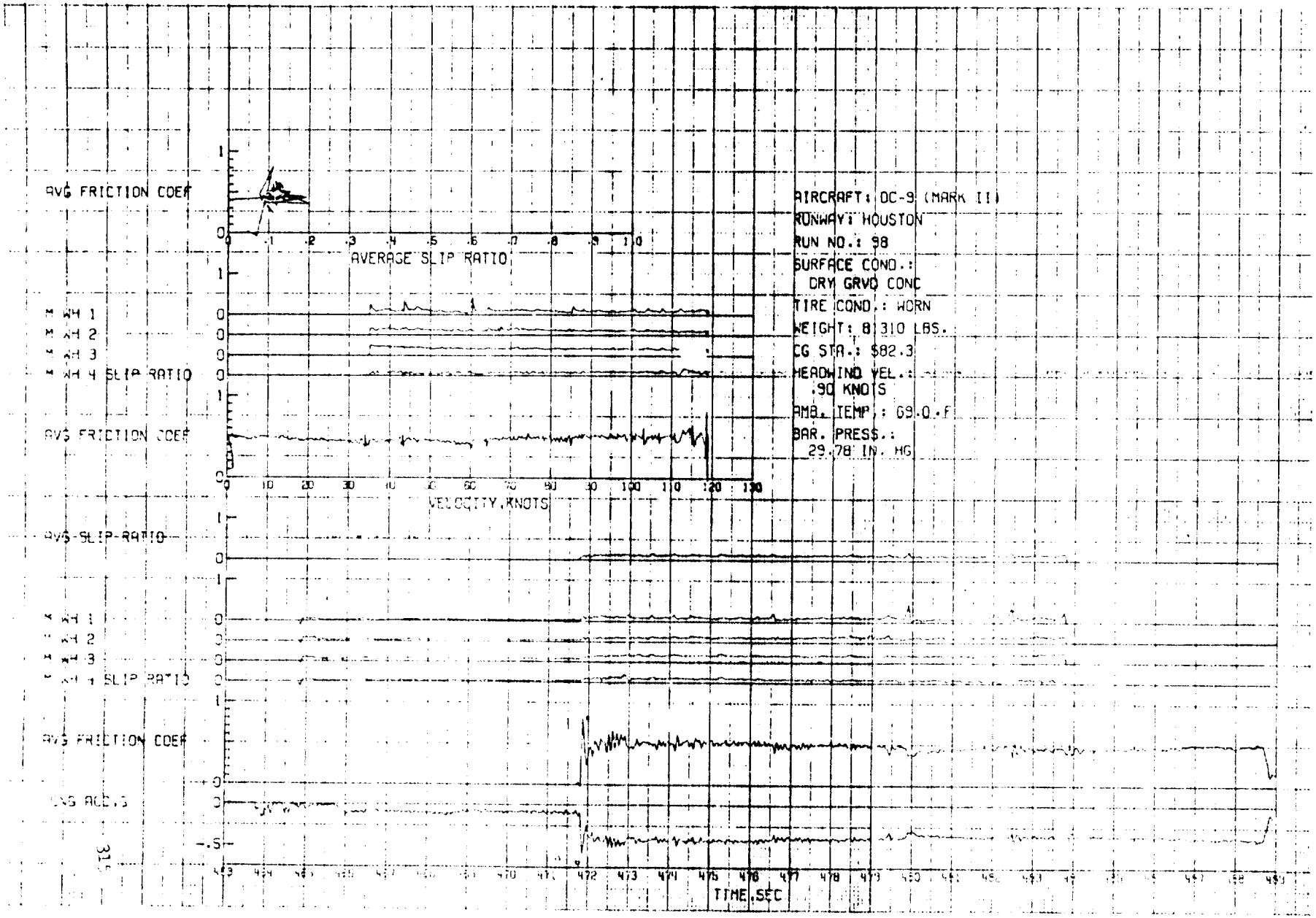


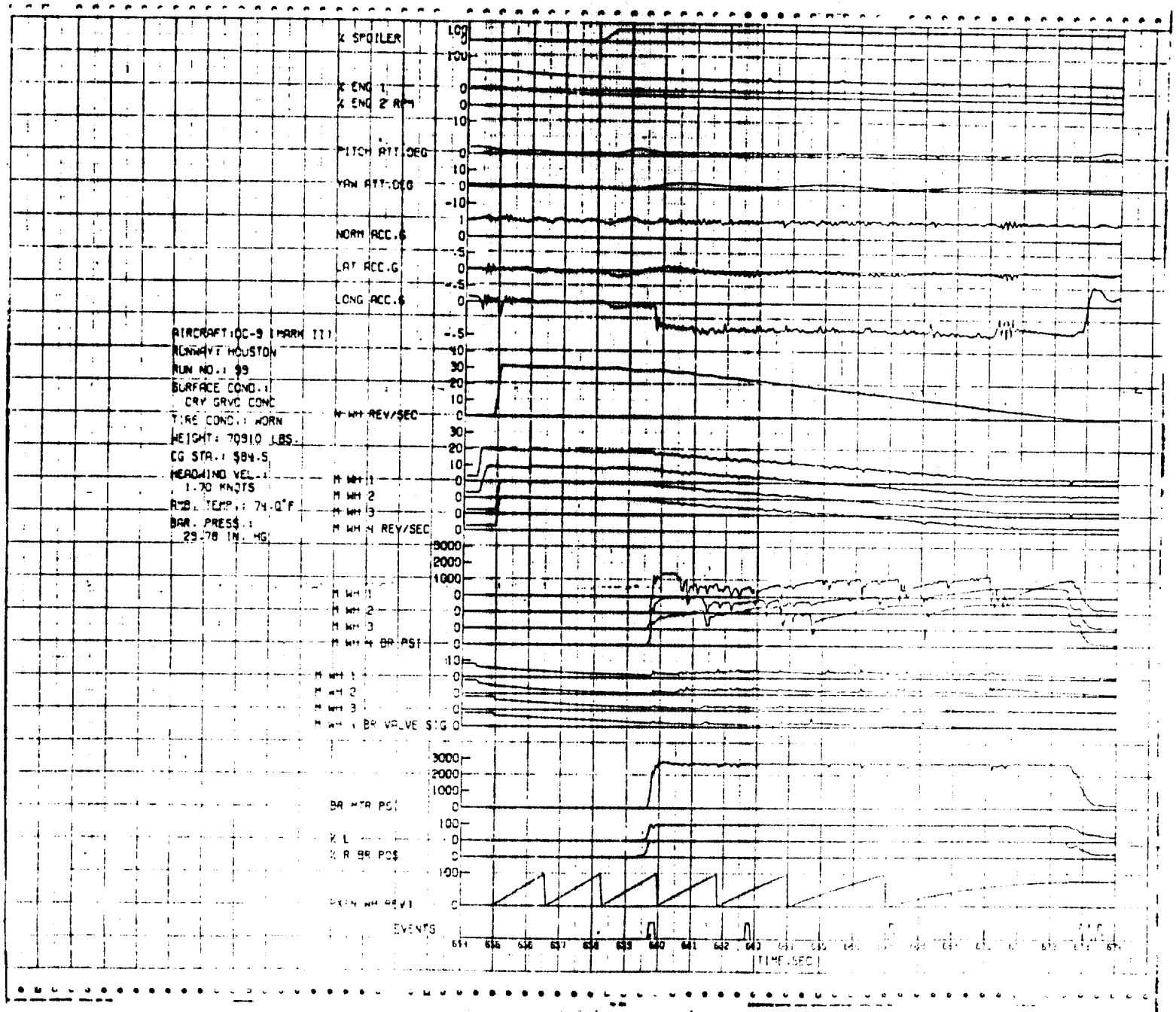

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC
AIRCRAFT: DC-9 (MARK II A)
RUNWAY: EDMONTON
RUN NO.: 15
SURFACE COND.:
SNOW ON CONC
TIRE COND.: WORN
WEIGHT: 76300 LBS.
CG STA.: 885.2
HEADWIND VEL.:
2.00 KNOTS
AMB. TEMP. [illegible] F
BAR. PRESS.:
27.69 IN. HG

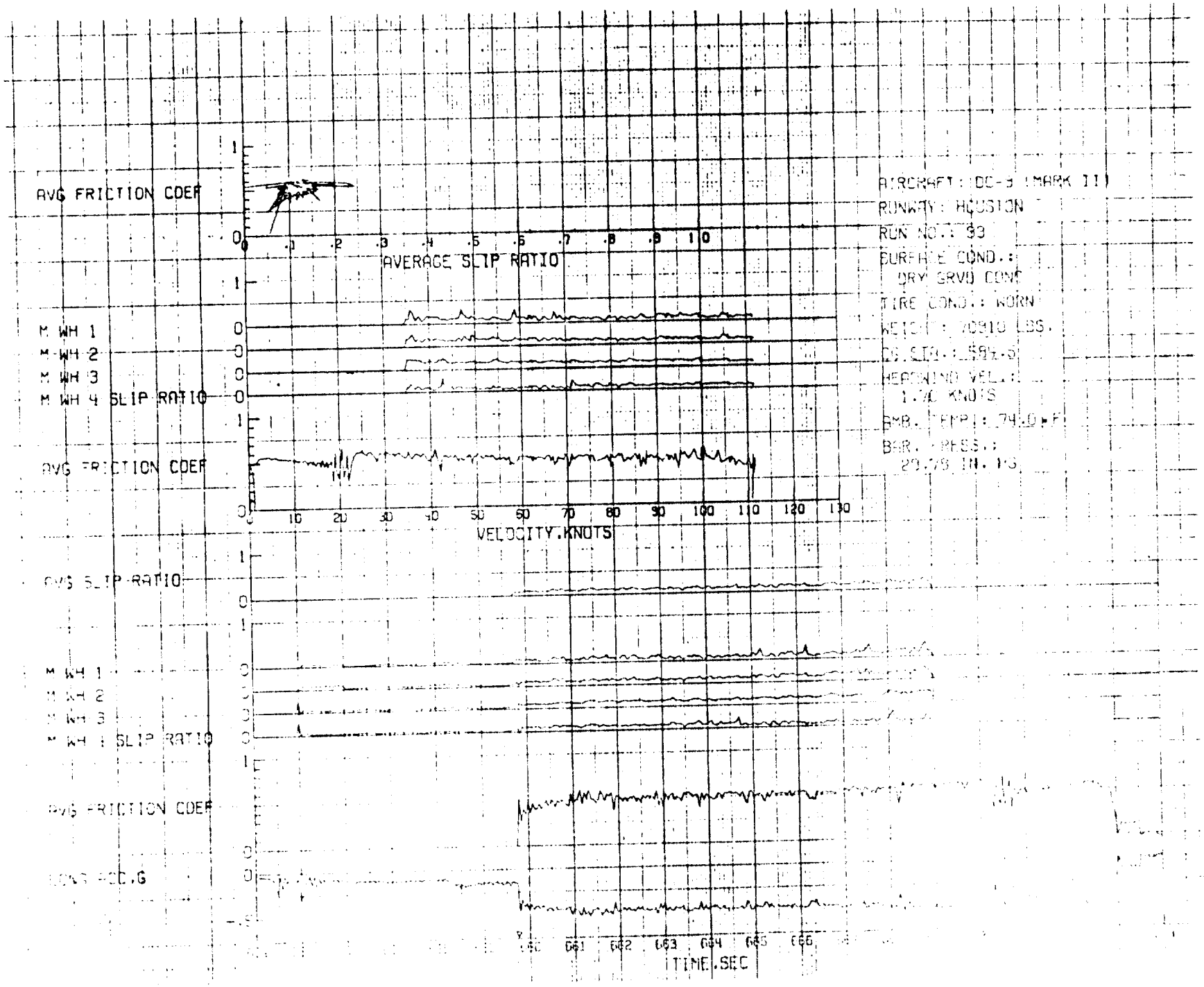

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT DEG
YAW ATT DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9
RUNWAY:
RUN NO.: 120
SURFACE COND.:
SNOW ON CONC
TIRE COND.: WORN
EQ STA.: SEA-3
1.90 KNOTS
AMB. TEMP.: 40°F
BAR. PRESS.:
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 4 BR VALVE
BR MFR PSI
BR PCS
EVENTS
TIME SEC

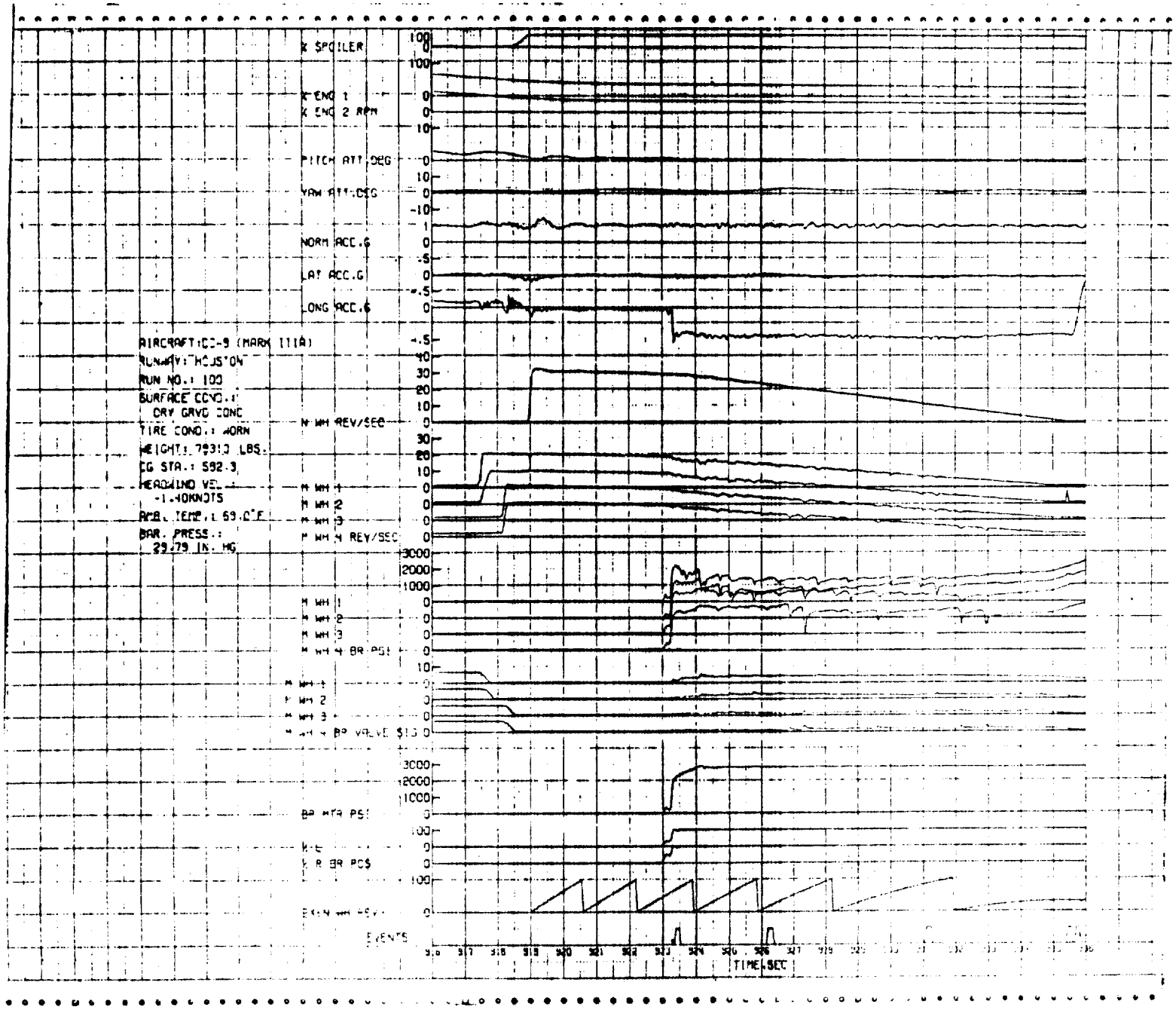

AVERAGE SLIP RATIO
VELOCITY, KNOTS

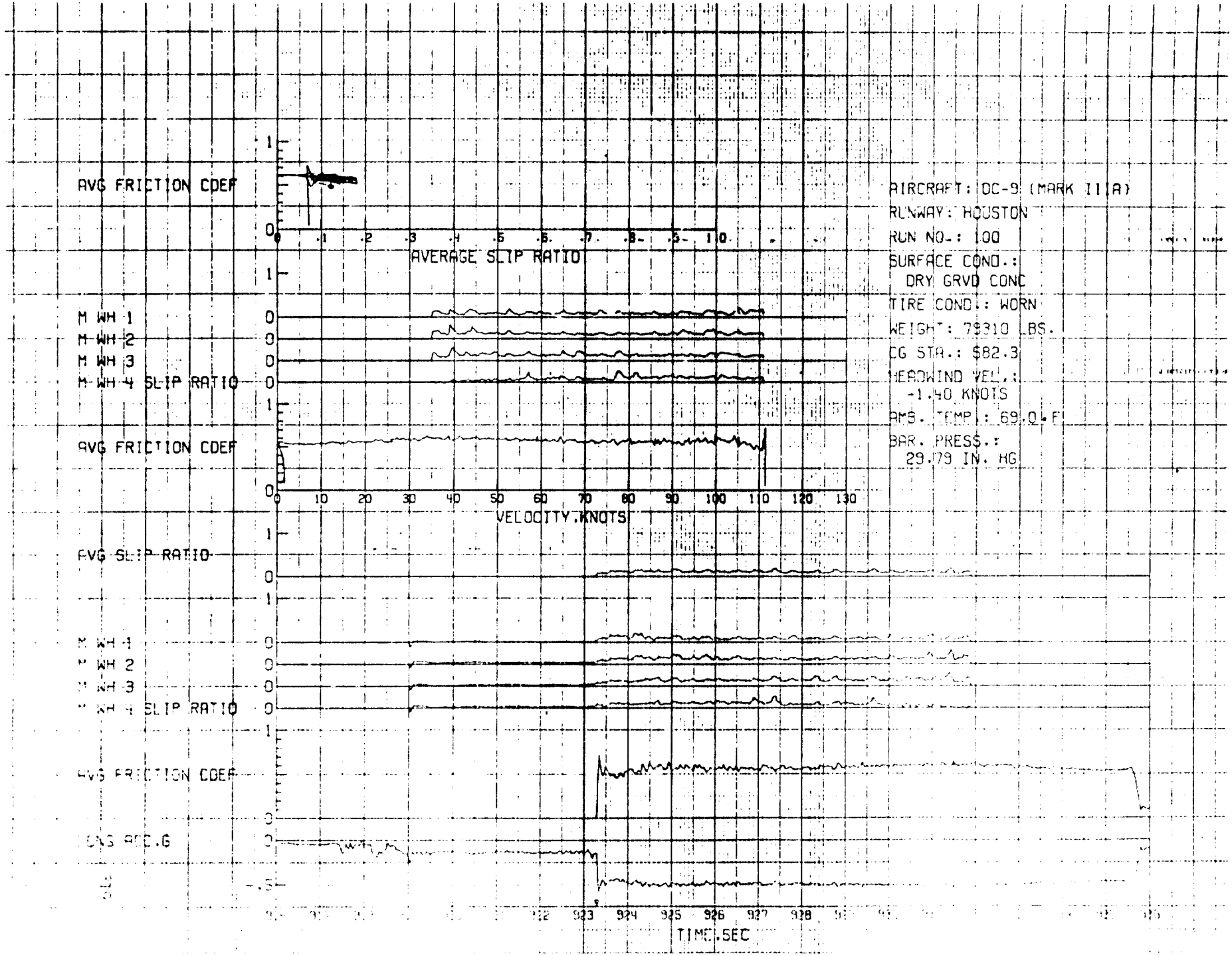

314
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-9 (MARK II)
RUNWAY: HOUSTON
RUN NO.: 98
SURFACE COND.:
DRY GRVD CONC
TIRE COND.: WORN
WEIGHT: 81310 LBS.
CG STA.: 582.3
HEADWIND VEL.:
90 KNOTS
AMB. TEMP.: 69.0°F
BAR. PRESS.:
29.78 IN. HG
WHEEL REV/SEC
WH 1
WH 2
WH 3
WH 4 REV/SEC
WH 1
WH 2
WH 3
WH 4 BR PSI
WH 1
WH 2
WH 3
WH 4 BR VALVE S.C.
BR MTR PSI
% E
% R BR POS
EVENTS
TIME SEC

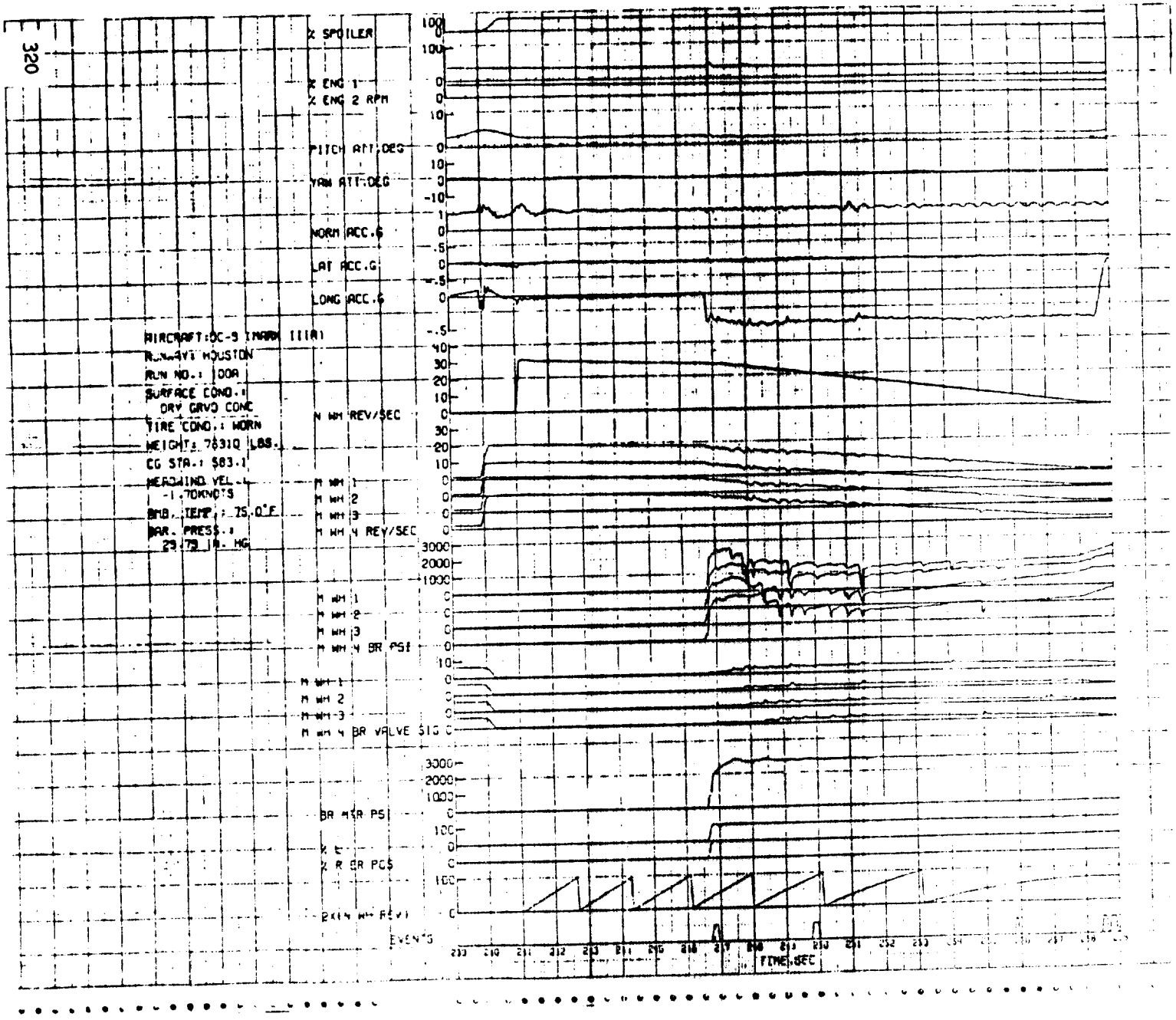

AVG FRICTION COEF
AVERAGE SLIP RATIO
AIRCRAFT: DC-9 (MARK II)
RUNWAY: HOUSTON
RUN NO.: 98
SURFACE COND.:
DRY GRVD CONC
TIRE COND.: WORN
WEIGHT: 81310 LBS.
CG STA.: 582.3
HEADWIND VEL.:
.90 KNOTS
AMB. TEMP.: 69.0 F
BAR. PRESS.:
29.78 IN. HG
WH 1
WH 2
WH 3
WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY, KNOTS
AVG SLIP RATIO
WH 1
WH 2
WH 3
WH 4 SLIP RATIO
AVG FRICTION COEF
AVG ACC.G
TIME, SEC

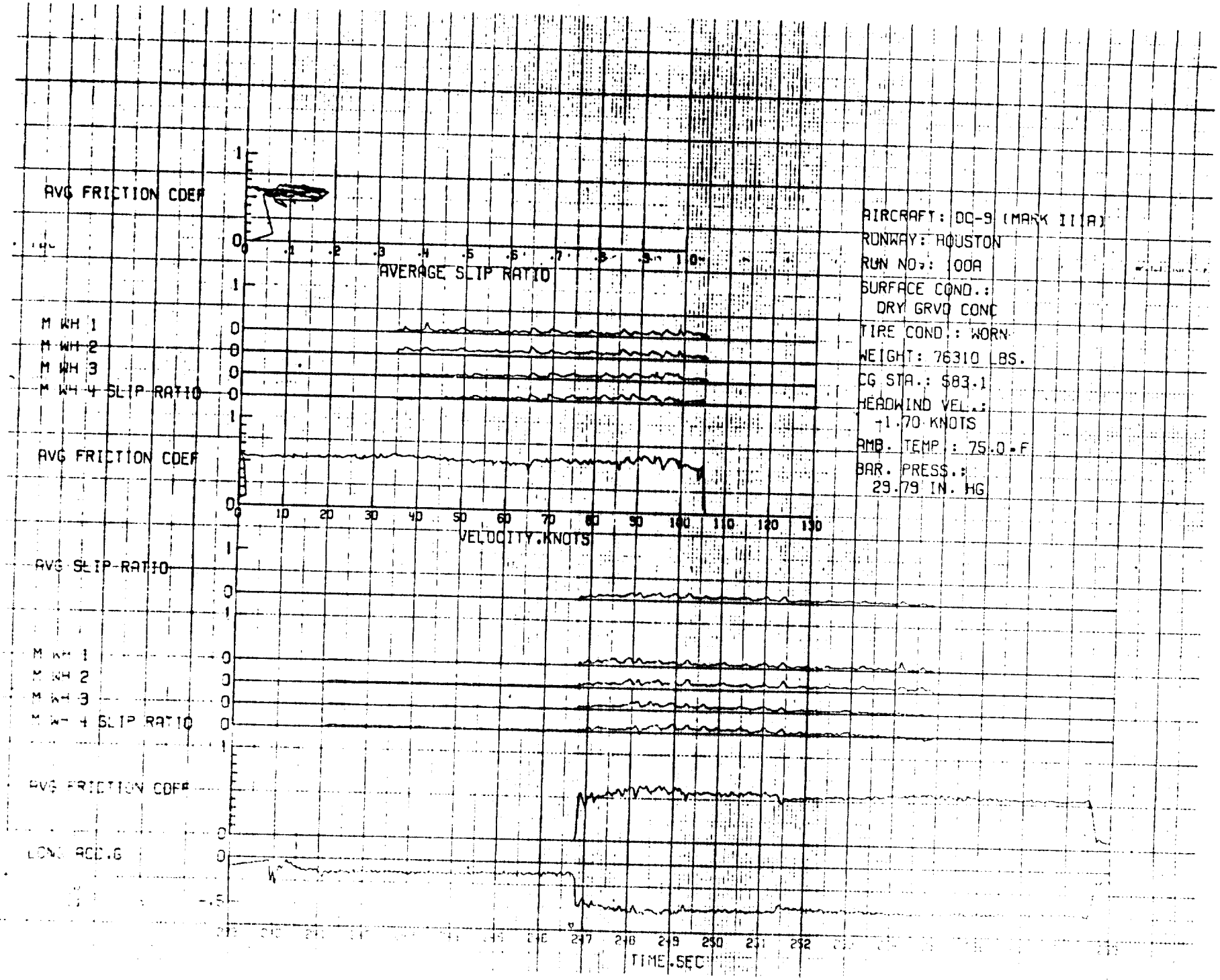

% SPOILER
% ENG 1 RPM
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (MARK II)
RUNWAY:T HOUSTON
RUN NO.: 99
SURFACE COND.:
DRY GRVC CONC
TIRE COND.: WORN
WEIGHT: 70910 LBS.
CG STA.: 884.5
HEADWIND VEL.:
1.70 KNOTS
AMB. TEMP.: 74.0°F
BAR. PRESS.:
29.78 IN. HG
M WH REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 BR PSI
M WH 1
M WH 2
M WH 3
M WH 4 BR VALVE SIG
BR MTR PSI
% L
% R BR POS
MAIN WH REV
EVENTS
TIME,SEC

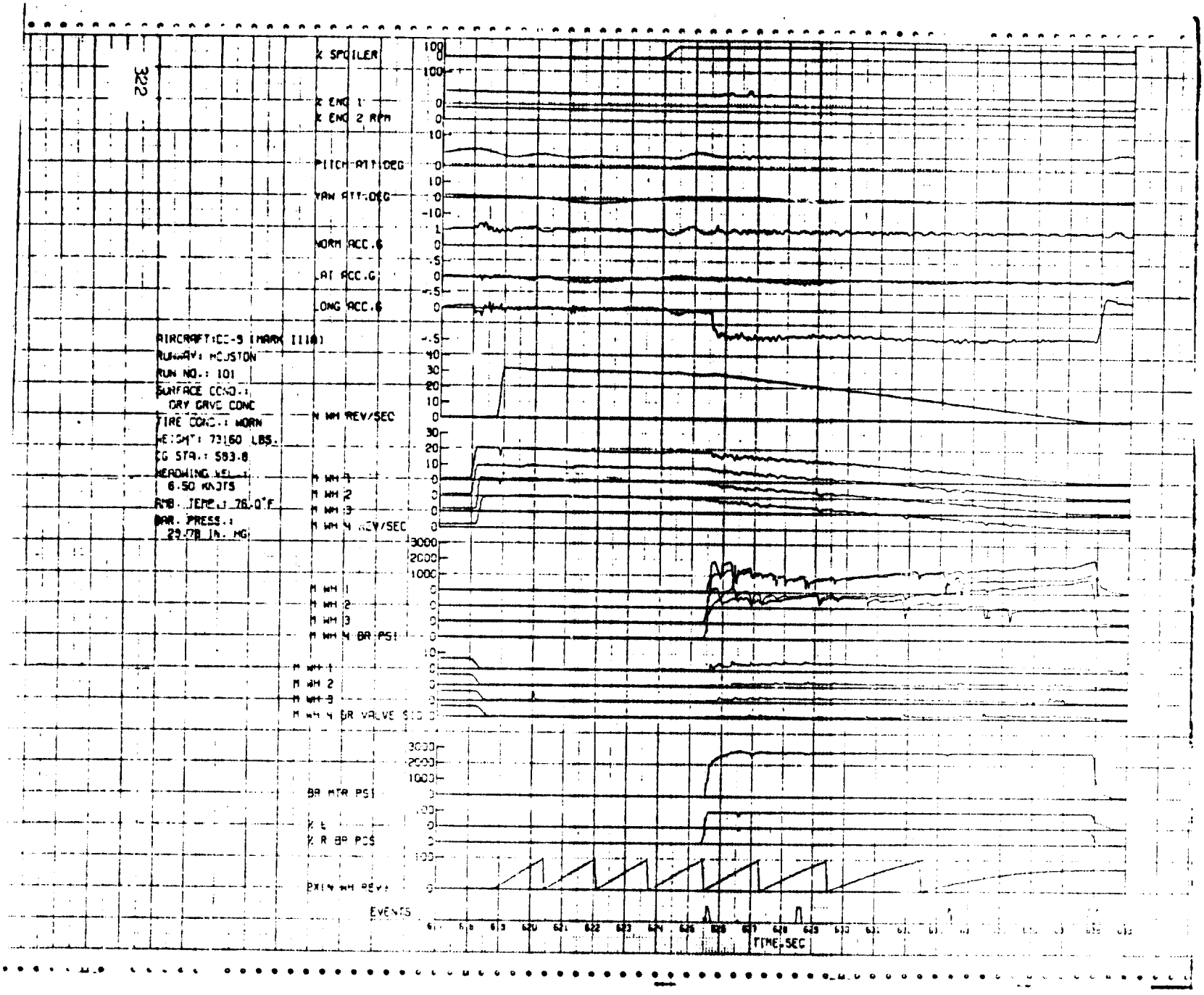

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: HOUSTON
RUN NO.: 33
SURFACE COND.:
DRY GRVD CONC
TIRE COND.: WORN
WEIGHT: 70910 LBS.
CG STA.: 599.5
HEADWIND VEL.:
1.70 KNOTS
AMB. TEMP.: 74.0 F
BAR. PRESS.:
29.75 IN. HG

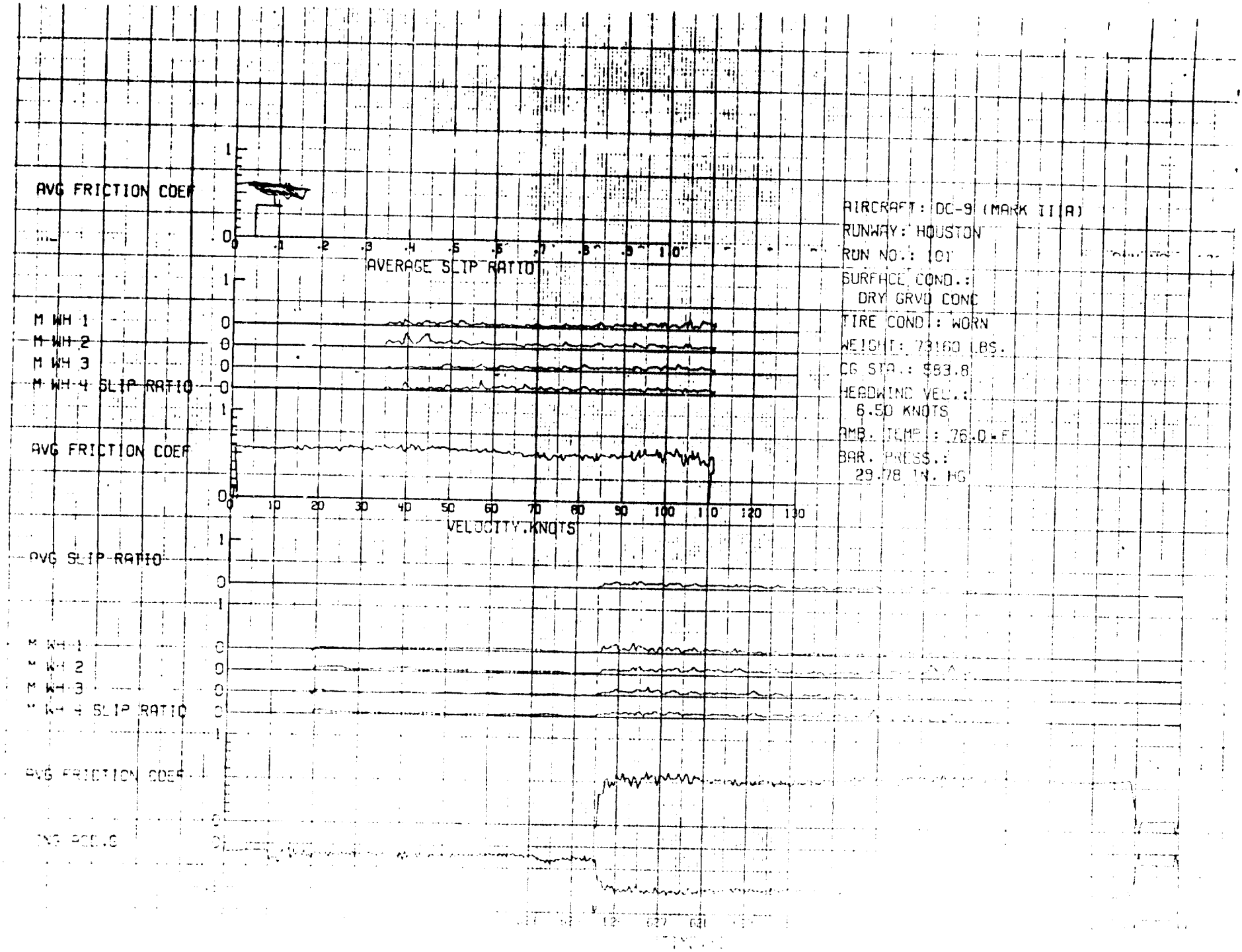

% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (MARK III)
RUNWAY:HOUSTON
RUN NO.: 100
SURFACE COND.:
DRY GRVD CONC
TIRE COND.: WORN
WEIGHT: 79310 LBS.
CG STA.: 592.3
HEADWIND VEL.:
-1.4KNOTS
AMB. TEMP.: 69.0°F
BAR. PRESS.:
29.79 IN. HG
EVENTS
TIME,SEC


AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
TIME,SEC
AIRCRAFT: DC-9 (MARK III A)
RUNWAY: HOUSTON
RUN NO.: 100
SURFACE COND.:
DRY GRVD CONC
TIRE COND.: WORN
WEIGHT: 78310 LBS.
CG STA.: 882.3
HEADWIND VEL.:
-1.40 KNOTS
AMB. TEMP.: 69.0 F
BAR. PRESS.:
29.79 IN. HG

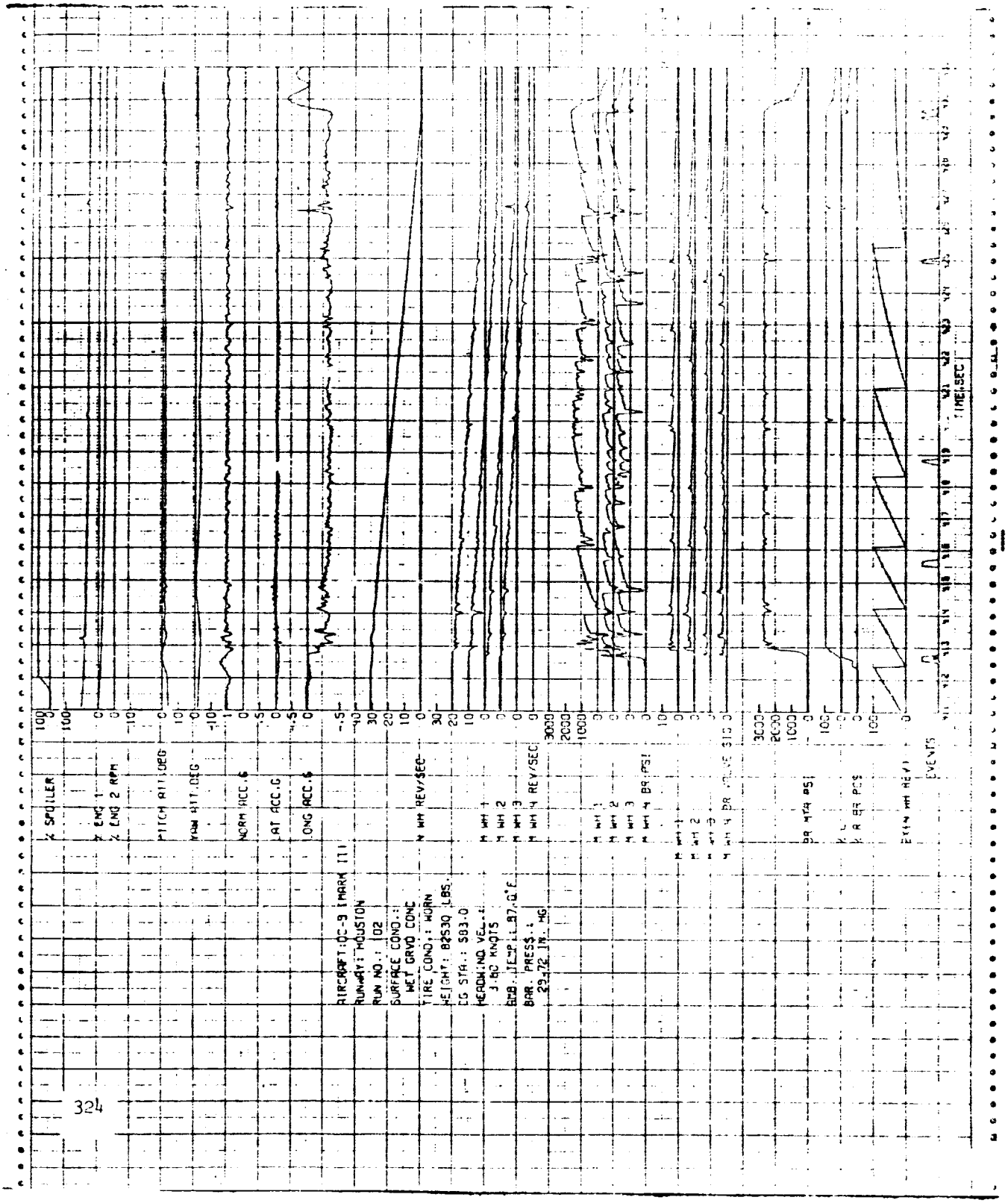

320
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (NASA 111A)
RUN NO.: 100A
SURFACE COND.:
DRY GRVD CONC
TIRE COND.: WORN
WEIGHT: 78310 LBS.
CG STA.: 583.1
HEADWIND VEL.:
-1.7KNOTS
AMB. TEMP.: 75.0°F
BAR. PRESS.:
29.79 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE STS
BR MSR PSI
% E
% R BR PCS
EVENTS
TIME,SEC

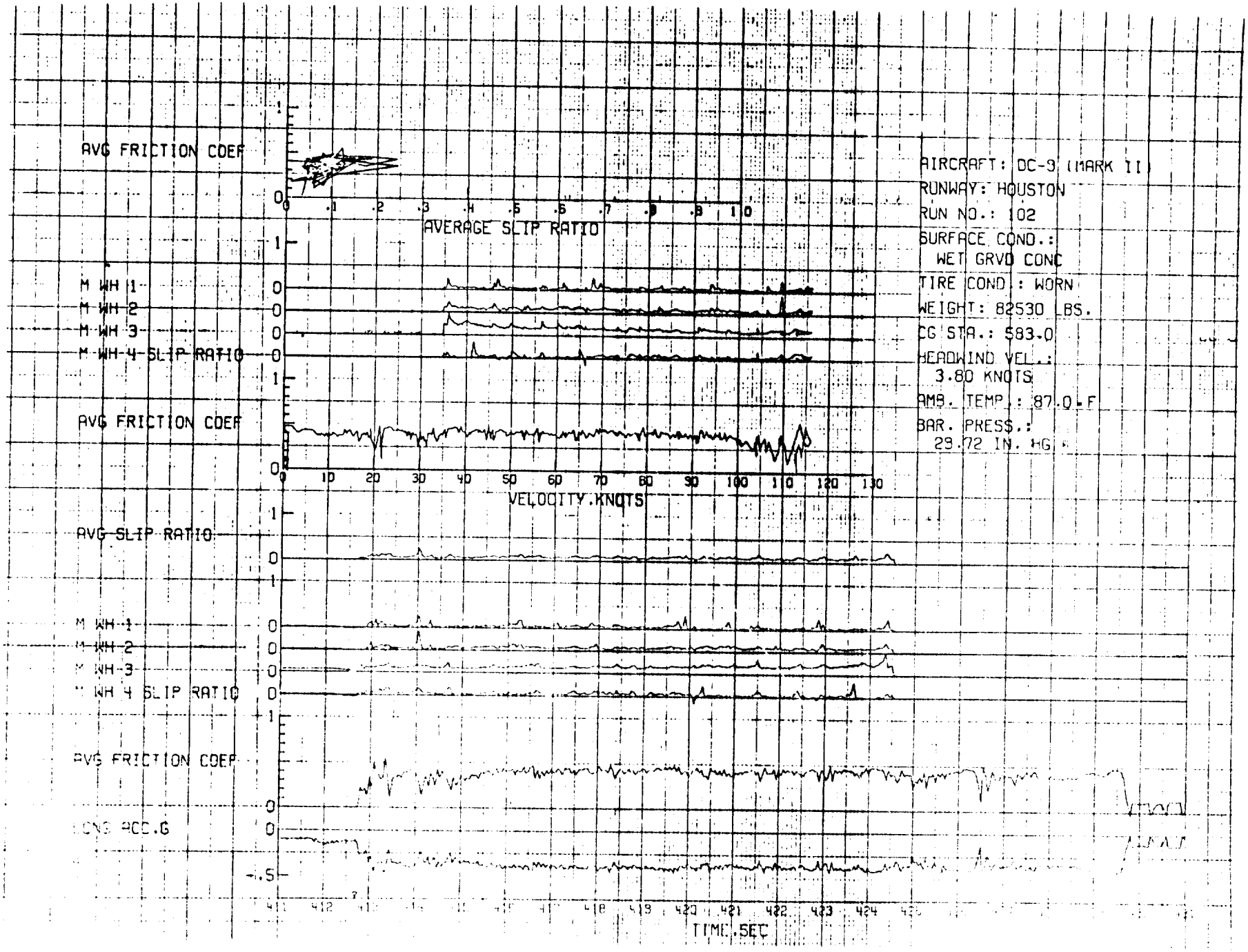

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC
AIRCRAFT: DC-9 (MARK III(A)
RUNWAY: HOUSTON
RUN NO.: 100A
SURFACE COND.:
DRY GRVD CONC
TIRE COND.: WORN
WEIGHT: 76310 LBS.
CG STA.: 583.1
HEADWIND VEL.:
+1.70 KNOTS
AMB. TEMP.: 75.0 F
BAR. PRESS.:
29.79 IN. HG


322
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT-DEG
YAW ATT-DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:CC-5 (MARK III@)
RUNWAY: HOUSTON
RUN NO.: 101
SURFACE COND.:
DRY GRVL CONC
TIRE COND.: WORN
WEIGHT: 73160 LBS.
CG STA.: 583.8
HEADWIND VEL.:
6.50 KNOTS
AMB. TEMP.: 76.0°F
BAR. PRESS.:
29.78 IN. HG
M WH REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 REV/SEC
M WH 1
M WH 2
M WH 3
M WH 4 BR PSI
M WH 1
M WH 2
M WH 3
M WH 4 BR VALVE SIG
BR MTR PSI
% L
% R BR POS
EVENTS
TIME,SEC

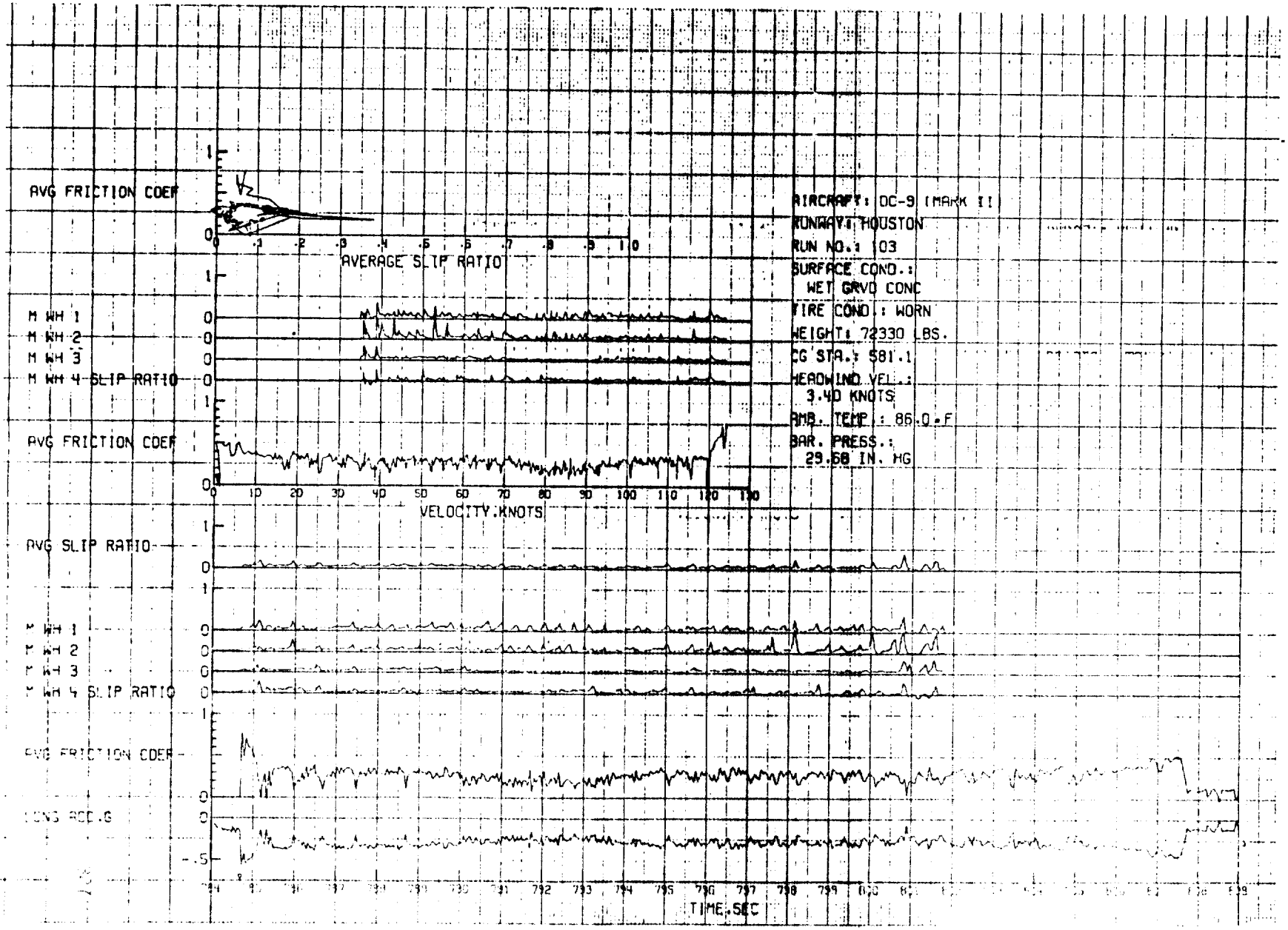

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY, KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
AIRCRAFT: DC-9 (MARK II(A)
RUNWAY: HOUSTON
RUN NO.: 101
SURFACE COND.:
DRY GRVD CONC
TIRE COND.: WORN
WEIGHT: 73160 LBS.
CG STA.: 883.8
HEADWIND VEL.:
6.50 KNOTS
AMB. TEMP.: 26.0 F
BAR. PRESS.:
29.78 IN. HG

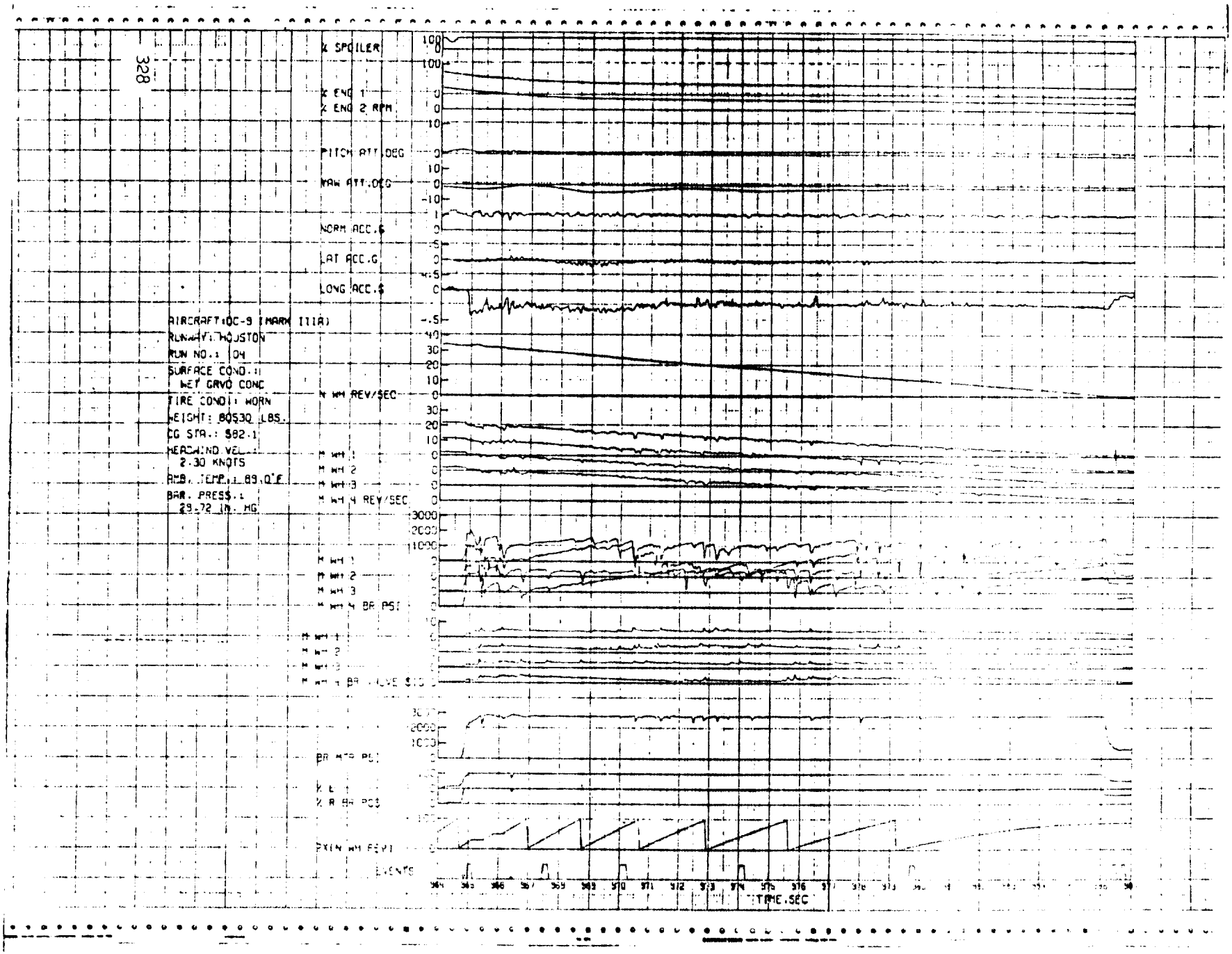
REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

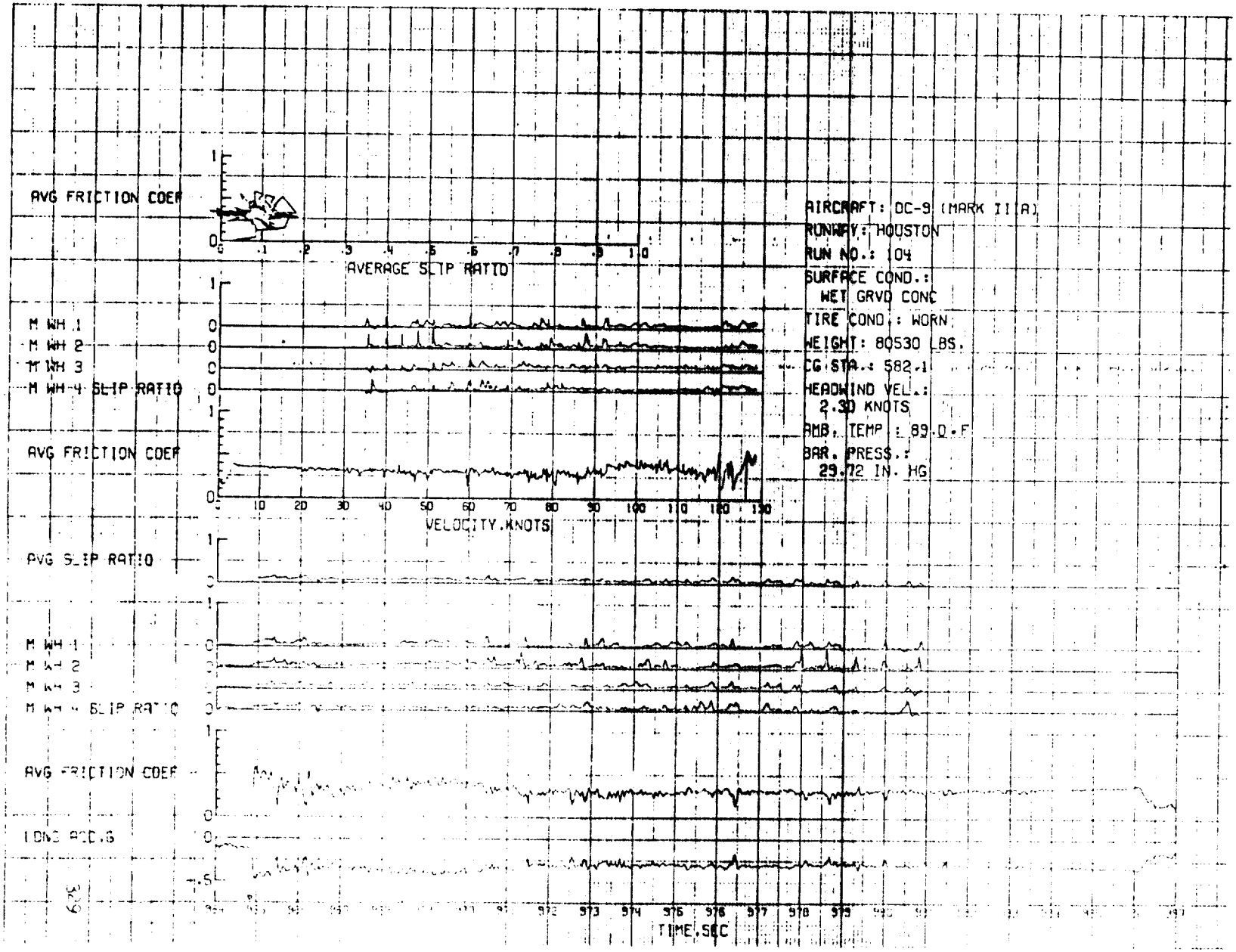


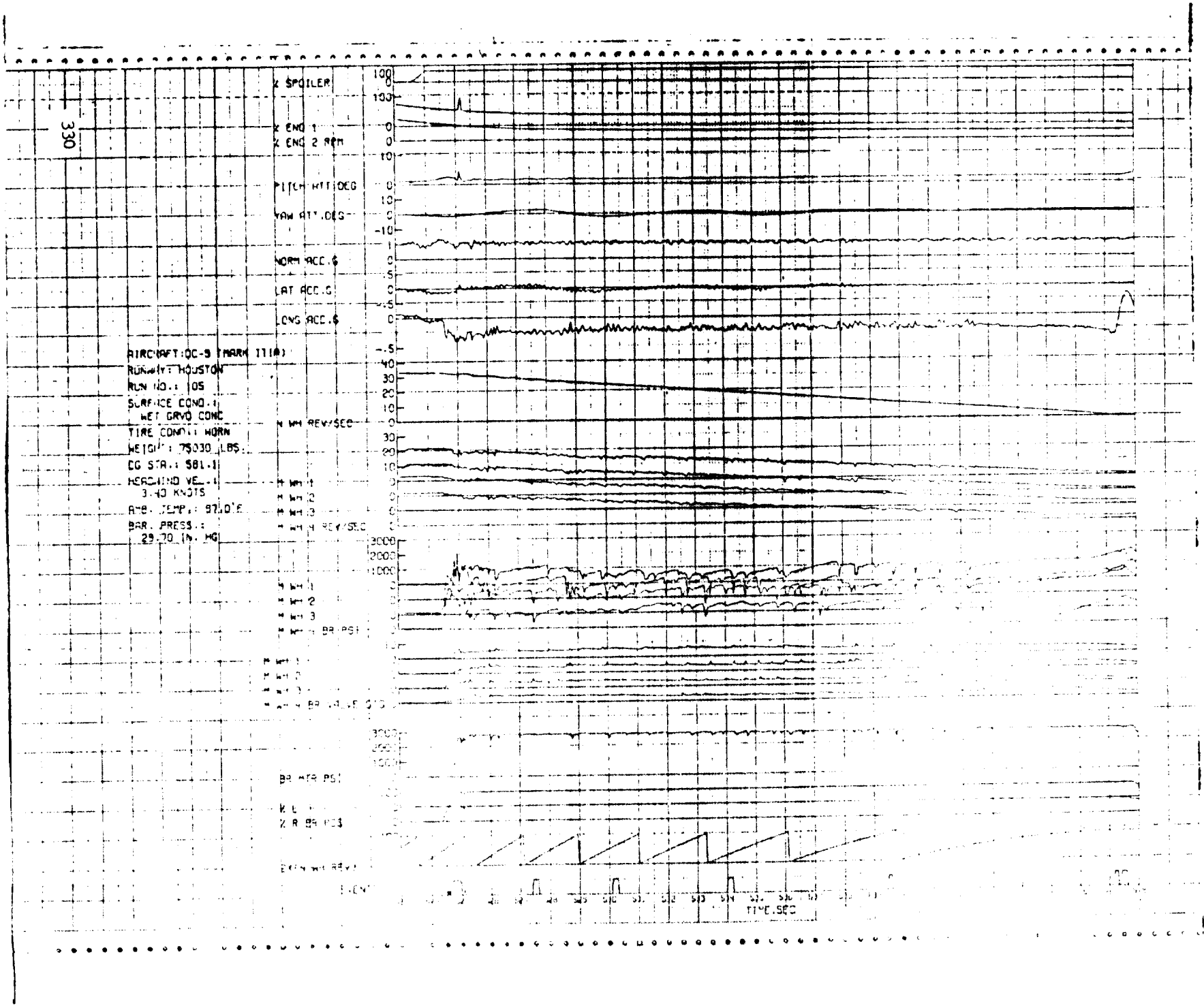

AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
CNS ACC.G
TIME.SEC
AIRCRAFT: DC-9 (MARK II)
RUNWAY: HOUSTON
RUN NO.: 102
SURFACE COND.:
WET GRVD CONC
TIRE COND.: WORN
WEIGHT: 82530 LBS.
CG STA.: 583.0
HEADWIND VEL.:
3.80 KNOTS
AMB. TEMP.: 87.0 F
BAR. PRES$.:
29.72 IN. HG

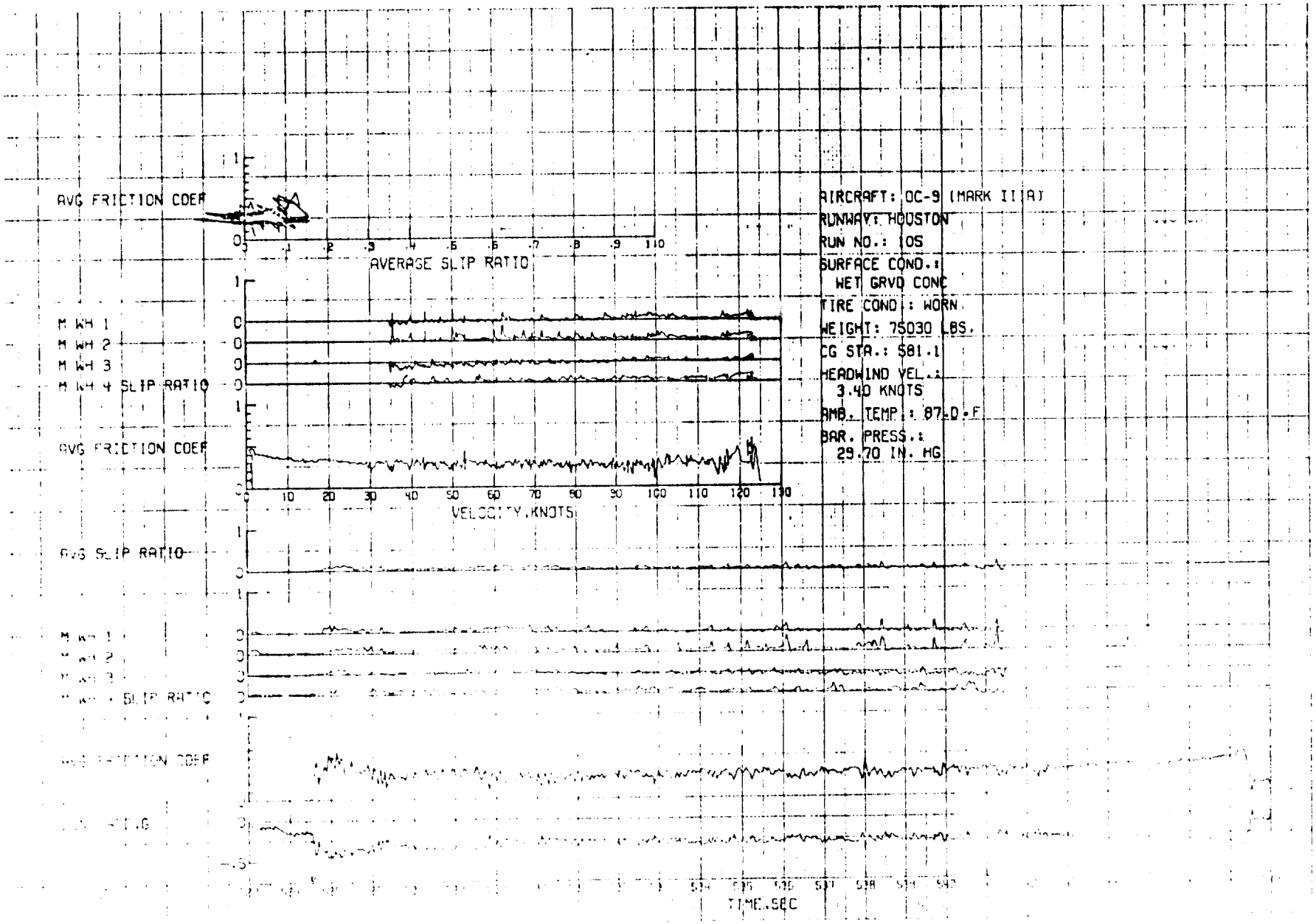
REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR


AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY.KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME.SEC
AIRCRAFT: DC-9 (MARK II
RUNWAY: HOUSTON
RUN NO.: 103
SURFACE COND.:
WET GRVD CONC
TIRE COND.: WORN
WEIGHT: 72330 LBS.
CG STA.: 581.1
HEADWIND VEL.:
3.40 KNOTS
AMB. TEMP.: 86.0 F
BAR. PRESS.:
29.68 IN. HG


328
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
MAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:DC-9 (MARK IIIA)
RUNWAY: HOUSTON
RUN NO.: 04
SURFACE COND.:
WET GRVD CONC
TIRE COND: WORN
WEIGHT: 80530 LBS.
CG STA.: 582.1
HEADWIND VEL.:
2.30 KNOTS
AMB. TEMP.: 89.0°F
BAR. PRESS.:
29.72 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
N WH 1
N WH 2
N WH 3
N WH 4 BR VALVE STS
BR MTR PSI
% L
% R BR POS
PXIN WH FSYS
EVENTS
TIME.SEC


AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY, KNOTS
AVG SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
LONG ACC.G
TIME, SEC
AIRCRAFT: DC-9 (MARK II(A)
RUNWAY: HOUSTON
RUN NO.: 104
SURFACE COND.:
WET GRVD CONC
TIRE COND.: WORN
WEIGHT: 80530 LBS.
CG STA.: 582.1
HEADWIND VEL.:
2.30 KNOTS
AMB. TEMP: 89.0 F
BAR. PRESS.:
29.72 IN. HG


330
% SPOILER
% ENG 1
% ENG 2 RPM
PITCH ATT.DEG
YAW ATT.DEG
NORM ACC.G
LAT ACC.G
LONG ACC.G
AIRCRAFT:OC-9 (MARK III)
RUNWAY: HOUSTON
RUN NO.: 105
SURFACE COND.:
WET GRVD CONC
TIRE COND.: WORN
WEIGHT: 75030 LBS.
CG STA.: 581.1
HEADWIND VEL.:
3.40 KNOTS
AMB. TEMP.: 87.0°F
BAR. PRESS.:
29.70 IN. HG
N WH REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 REV/SEC
N WH 1
N WH 2
N WH 3
N WH 4 BR PSI
BR MTR PSI
% L BR PSI
% R BR PSI
TIME,SEC


AVG FRICTION COEF
AVERAGE SLIP RATIO
M WH 1
M WH 2
M WH 3
M WH 4 SLIP RATIO
AVG FRICTION COEF
VELOCITY,KNOTS
AVG SLIP RATIO
TIME,SEC
AIRCRAFT: DC-9 (MARK II A)
RUNWAY: HOUSTON
RUN NO.: 10S
SURFACE COND.:
WET GRVD CONC
TIRE COND.: WORN
WEIGHT: 75030 LBS.
CG STA.: 581.1
HEADWIND VEL.:
3.40 KNOTS
AMB. TEMP.: 87.0 F
BAR. PRESS.:
29.70 IN. HG

END

DATE

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